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R-572-ARPA

February 1971

BORDER SECURITY IN SOUTH VIETNAM (U)

M. B. Schaffer and M. G. Weiner

A Report prepared for

ADVANCED RESEARCH PROJECTS AGENCY

Rand

SANTA MONICA, CA 90406

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PREFACE

(U) This report, a summary of a study on border security in South Vietnam prepared for the Advanced Research Projects Agency, is concerned specifically with infiltration of personnel across the land borders of South Vietnam. It does not consider truck traffic on the Ho Chi Minh Trail, or potential infiltration by sea or air. For the most part it comprises substantive findings rather than methodology. Other Rand reports of the border security study include R-483-ARPA, The Land Border of South Vietnam: Some Physical and Cultural Characteristics; RM-5936-ARPA, Boundary Concepts and Practices in Southeast Asia; RM-6021-1-ARPA, A Model Relating Infiltration Restriction Systems and Force Levels; RM-6338-ARPA, A Dynamic Programming Approach to Network Problems: A Model for On-Line Computer Systems; and RM-6250-ARPA, Analytic Model of Border Control.

SUMMARY

(C) Since the mid-1950s, North Vietnam has been infiltrating personnel into South Vietnam. This infiltration has largely shaped the scope and character of the conflict in Southeast Asia.

(C) This report considers various military means of reducing infiltration across the land border of South Vietnam. It assumes that U.S. forces will continue to be withdrawn as the Vietnamization program (also known as the Vietnamese Improvement and Modernization or VIM program) progresses.

(S) Three means are considered:

1) An enhanced border surveillance program without redeployment of additional forces to the border area.
2) The installation of a series of strong-points, manned by forces either redeployed from the interior or already based in the border area.
3) The installation of a physical barrier along with the strong-points.

ENHANCED BORDER SURVEILLANCE

(S) The enhanced border surveillance program would employ a variety of radars and remotely emplaced sensors, plus the associated air, ground relay equipment, and data-handling facilities. The program is estimated to cost between $30 million and $70 million annually over a five-year period. The difference is based on the number of infiltration routes monitored and the threat level (characterized for this system by the fraction of the border subject to infiltration). Such a system would provide increased intelligence on enemy concentrations and movements in the border area and lead to improved targeting. However, there are few or no ground forces or artillery bases in many areas to take immediate advantage of such enhanced surveillance. And in the absence of air units dedicated to border control, and antipersonnel weapons and other specialized equipment developed specifically for the task, programmed tactical air resources would be

inadequate to provide a timely response--at least at the level of infiltration (100,000 per year) assumed in this study. At best, we estimate a 10 percent increase in the attrition of infiltrators with this system.

(S) Finally, if the South Vietnamese were to implement the enhanced surveillance system under the VIM plan, a large training program in the use, maintenance, and management of sensors and associated data-handling equipment would be required. Among the major items of equipment required for the task, which are not presently programmed, would be 24 Pave Eagle (YQU-22A) relay aircraft.

STRONG-POINT SYSTEM

(S) The strong-point system would require some redeployment of forces from the interior to many parts of the border. Each strong-point would be a semi-independent defense installation, manned by an infantry battalion with organic artillery, and supported by remotely based helicopters. Used in conjunction with the enhanced surveillance system, it would employ patrols capable of summoning artillery, air or ground support, and that are also equipped with portable sensors and ordnance to detect and attack enemy infiltration. A series of strong-points along the entire border (the early-1970 situation, corresponding to our high-threat level) would require about 79,000 troops (exclusive of rear support) and cost an additional $312 million annually over a five-year period, exclusive of troop costs. For a lower threat level (typified by that existing during the summer of 1970; i.e., possible incursions from the Parrot's Beak and north), the required manning would be 55,000 troops and the additional five-year annual costs would be $216 million. In both cases, a significant fraction of the manning (at least 20,000) could be supplied by paramilitary forces already engaged in border security duties.

CONTINUOUS BARRIER

(S) The installation of a barrier together with the strong-points and the enhanced surveillance system would not require additional troops beyond those for the strong-points, but would raise the cost to an

estimated $412 to $592 million annually over a five-year period, depending on the threat. Among the major items of equipment required for either of the manned systems as an augmentation of the VIM program would be 160 to 230 UH-1 (type) helicopters, and 95 to 270 155mm artillery tubes, again depending on the threat.

EFFECTIVENESS OF MANNED SYSTEMS

(S) To estimate the effectiveness of the two manned systems, we assume three levels of enemy threat: infiltration units of six-men each and of 40-men each for the summer-1970 situation; and of 400-men each for the early-1970 situation, with an annual level of 100,000 infiltration attempts in each case. We make a variety of assumptions about the ability of the systems to detect and respond to infiltrators, the type of terrain, the dedication (or resolve) of the infiltrators, etc. Sensitivity analyses were conducted where feasible to test the importance of these assumptions.

(S) In general, the strong-point system would attrit or deter at least 85 percent of either the 6-man groups or the 40-man groups. For 100,000 infiltration attempts, defender casualties are estimated at less than 3000. Against 400-man groups, the strong-point system would be less efficient with our lower-bound estimate being of the order of 50 percent. Defender casualties on a corresponding basis are estimated at under 1000.

(S) The addition of the barrier to the strong-point system improves the level of effectiveness in each case, primarily because of the complete surveillance of the border area provided. Against the 6- and 40-man infiltrating groups, the system effectiveness is estimated at upwards of 99 percent with defender casualties of less than 1000. Against 400-man groups, the system effectiveness is estimated at upwards of 70 percent with defender casualties of about 1000.

COST-EFFECTIVENESS OF MANNED SYSTEMS

(S) However, although the barrier system appears to be the most effective, it is not the most cost-effective. Our analysis in this

respect is based on a VC/NVA manpower input-output balance over a five-year time-frame. We conclude that either of the manned systems should reduce the enemy in-country strength to a low level based on 1969 attrition and local recruitment rates. This result is sensitive, however, to the vigor with which the in-country war is pursued. For example, if the attrition rate drops to half that of the 1969 level, none of the systems will reduce the enemy force to acceptable levels within five years.

(S) Therefore, based on costs, effectiveness, and the difficulty of installing a barrier in the face of enemy opposition, we rule it out as an acceptable solution. Of the alternatives considered, the preferable one is the installation of strong-points combined with an enhanced border surveillance program.

POLITICAL AND CULTURAL CONSIDERATIONS

(S) The extent to which a large-scale program of improved border security can be undertaken will depend, in part, on the developing political situation in South Vietnam. Any agreements or negotiations that fix the location of forces might prevent them from being employed in the border area. Similarly, an internal situation requiring the present forces to remain committed to internal security operations (protection of key population areas, lines of communication, and pacification efforts) would preclude their availability for deployment in a large-scale program to improve border security. No attempt is made to assess the likelihood of these conditions occurring.

(S) Some of the implications of deploying a large number of RVN forces to the border are considered. Issues concerned with using only forces of the Army of the Republic of Vietnam (ARVN) include: possible reluctance of ARVN commanders to redeploy forces, ARVN dislike of remote-area service, strained relations with the Montagnards, and the ARVN practice of bringing their dependents with them when stationed away from home.

(S) The use of "mixed" manning in which Regional Forces (RF) or Civilian Irregular Defense Groups (CIDG) are used as the patrol troops and ARVN forces provide the artillery support and reaction forces is

one alternative that would reduce the number of ARVN troops that would have to be redeployed to the border. Some of the issues involved in operations of a mixed CIDG-RF-ARVN force are considered. The use of special incentives in pay, housing, land titles, etc. are regarded as possible means of ameliorating some of the problems.

SYSTEM IMPLEMENTATION

(S) Prudence dictates that a pilot effort be undertaken before embarking on a country-wide border control installation. This would involve installation of strong-points in a few selected areas in order to identify problems in construction or manning, in enemy reaction, in the impact on the VIM program, in the effect on internal security, etc. If the results of the initial installations indicate adverse effects, the program could be modified, postponed, or abandoned. If the results are favorable, a more comprehensive program of installations could be initiated.

(S) All things considered, the installation of a border control system to inhibit ground infiltration into South Vietnam is considered a difficult but feasible undertaking. If installed in timely fashion, it could be effective in keeping casualties of the Vietnamese armed forces at a low level and yet accomplish the long-range goals of the Republic of South Vietnam.

ACKNOWLEDGMENTS

(U) A large number of people have contributed to parts of this report. In particular, the authors wish to express their appreciation to John Dudzinsky, Jack Ellis, Leon Gouré, William Nance, Hans Schechter, Harold Steingold, and Col. Kenneth Strother, USA (Ret.), for their assistance.

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FIGURES

TABLES

ACRONYMS

ARPA	Advanced Research Projects Agency
ARVN	Army of the Republic of Vietnam
BASS	Battlefield Air Surveillance System
BPS	balanced pressure system
CEP	circular probable error
CIDG	Civilian Irregular Defense Group
CIT	combined instruction teams
COIN	counterinsurgency
CTZ	Corps Tactical Zone
DART	Deployable Automatic Relay Terminal
DASC	Direct Air Support Center
DCPG	Defense Communications Planning Group
DMZ	demilitarized zone
FAE	fuel-air explosive (munition)
FSB	fire-support base(s)
FULRO	United Fighting Front of the Oppressed Races (now the Movement for the Unity of the Southern Highlands Minority Party)
HE	high-explosive
ICM	improved conventional munition
KIA	killed in action
LOCs	lines of communication
MACV	Military Assistance Command, Vietnam
MCID	multi-purpose concealed intrusion detector
MLIP	most likely intercept point
MTI	moving-target indicator
NOD	night observation device(s)
NLF	National Liberation Front
NVA	North Vietnamese Army
OJT	on-the-job training
PSDF	People's Self-Defense Forces
QRF	quick-reaction force(s)
RD(C)	Revolutionary Development (Cadre)
RF	radio frequency; Regional Forces

RVN	Republic of Vietnam
RVNAF	Republic of Vietnam Armed Forces
SAB	semi-automatic barrier
SCAMP	(U.S.) sensor control and management platoons
SEA	Southeast Asia
SEA LORDS	Southeast Asia Lake, Ocean, River, Delta Strategy
SEATO	Southeast Asia Treaty Organization
SIP	surveillance-interdiction patrol(s)
SLS	starlight scope(s)
SLV	SEA LORDS Van(s)
SRP	Sensor Reporting Post
SVN	South Vietnam
TACC	Tactical Air Control Center
TAOR	tactical area(s) of responsibility
TFA	Task Force Alpha
TLT	(DCPG) technical liaison teams
TOC	Tactical Operations Center
TSC	Tactical Surveillance Center
VC	Viet Cong
VIM	Vietnamese Improvement and Modernization program
VNAF	Vietnamese Air Force
VNMC	Vietnamese Marine Corps
VNN	Vietnamese Navy
VT	variable time or proximity (fuzing)

I. INTRODUCTION

(C) Since the mid 1950's, North Vietnam has been infiltrating personnel and supplies into South Vietnam as part of a program "to liberate the South and proceed toward reunifying the country."[(1)] By 1962 an estimated 25,000 infiltrators had entered South Vietnam. Since 1963, when approximately 8000 infiltrators crossed the border, the number has increased each year.[(2)] In 1968, an estimated 200,000 enemy personnel infiltrated South Vietnam.

(U) The infiltration of personnel and supplies from North Vietnam has significantly shaped the nature and scale of the conflict in Southeast Asia. It greatly influenced U.S. decisions to commit substantial ground, air, and naval forces, and to extend the conflict from South Vietnam into Laos, North Vietnam, and more recently into Cambodia.

(C) As early as 1961, well before any large military commitment to South Vietnam, the seriousness of North Vietnamese infiltration was recognized, although apparently not in its full magnitude. ARPA-sponsored studies by the Combat Development Test Center (Vietnam) in 1961 and again in 1964 urged the installation of a "cordon sanitaire" along selected parts of the border.[(3)] These studies proposed cleared strips, radar, war dogs, and mine fields as means for detecting and inhibiting infiltration. They were never implemented, because of the expense involved relative to the scale of the war then in process, and because they were subsumed in other efforts such as the Strategic Hamlet Program. Studies of border security were also conducted by the Engineer Strategic Studies Group of the Department of the Army in 1966[(4)] and by the U.S. Army Combat Development Command Institute of Special Studies in 1967.[(5)] These latter two groups of studies provide some of the data in this report.

(U) Subsequent to the U.S. buildup in South Vietnam, many programs to reduce or stop infiltration have been implemented. On a political level, there have been repeated attempts to induce or coerce North Vietnam to cease its support of the war and to negotiate a settlement. Militarily, there have been naval operations to prevent infiltration by sea, and air attacks on North Vietnam's support facilities, logistic

routes, and supply system as well as on the routes and vehicles used in Laos. Despite these attempts, personnel infiltration not only continued, but increased, at least through 1968.*

(C) As North Vietnamese infiltration posed a growing military and political threat, a number of means for countering it in the border areas of South Vietnam were considered. Some of these, described in Sec. III of this report, were implemented. But a number of considerations (discussed below) made it infeasible to undertake a comprehensive border security program, i.e., a program to counter infiltration along the entire land border of South Vietnam.

PROTECTION OF HIGH-VALUE AREAS

(C) As the insurgency within South Vietnam grew, available military resources of the Army of the Republic of Vietnam (ARVN) were committed to the protection of high-value areas. These included the populated coastal regions of South Vietnam, the Delta area, and the demilitarized zone (DMZ) between North and South Vietnam as well as some of the main lines of communication (LOCs) within the country. Other forces--e.g., Regional Forces (RF)--also provided protection to the main provincial and district capitals and key hamlets. These protection or "internal security" missions (including pacification) were also included among the missions of U.S. forces committed to South Vietnam, although "the prime responsibility of these forces was to find and defeat the enemy's main forces and thereby to drive the enemy away from the populated areas."(6)

LOW VALUE OF BORDER AREAS

(C) The more remote border areas, particularly those of the Central Highlands, are jungle covered, mountainous regions, sparsely populated by ethnic minority groups (the Montagnards). In these areas,

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*(C) Preliminary information indicates that the number of infiltrators dropped to about 100,000 in 1969 and has been at an even lower rate for the early part of 1970.

th. bo er is poorly delineated;* and relations between the Montagnards and th tral government were strained. The Military Assistance Command, Vietnam (MACV), apparently did not consider committing large resources to counter infiltration in these border areas a priority mission for the available military forces.**

LACK OF ADEQUATE RESOURCES

(C) The Viet Cong (VC) and the North Vietnamese infiltrators had established a number of base areas in the border regions. These base areas, often involving complex underground storage and living facilities, were well-defended. Large-scale combat operations were required to dislodge the enemy in these areas and to capture his supplies. Emphasis on internal security and pacification of more populated areas took precedence over actions against these border bases. The enemy also established bases across the border in Laos and Cambodia where ground forces were not initially permitted to attack, but from which attacks into South Vietnam could be mounted by the enemy.

(U) These, and other considerations, precluded any major attempt to establish a comprehensive border security program.*** In effect, they gave the enemy free access to much of the border area, particularly in the more remote regions, and facilitated heavy infiltration into South Vietnam.

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*(U) This situation is more extensively discussed in Ref. 7, one of the supporting reports of this study.

**(S) Civilian Irregular Defense Groups (CIDG) were organized and equipped by the U.S. Army Special Forces in selected locations on or near the border. These paramilitary forces had only a loose connection with MACV and were never deployed in sufficient numbers to stop or significantly decrease the infiltration, even though this was their primary mission.

***(S) In the summer and fall of 1966, an Institute for Defense Analysis JASON study group recommended that an air-supported anti-infiltration barrier be installed south of the demilitarized zone in South Vietnam extending some 40 km into Laos. The Laotian portion of the barrier was intended to interdict truck traffic on the Ho Chi Minh Trail. Implemented in late 1967, this program is called the Igloo White operation. For a variety of reasons, the DMZ barrier, intended to interdict foot traffic was not installed.(8)

(U) As a growing number of U.S. and Free World forces were committed to Southeast Asia, the increased firepower and mobility began to inflict heavy casualties on the enemy despite the fact that he still maintained significant offensive capabilities. The high point of the enemy's military activities probably occurred in early 1968 with the Tet offensive and the siege of Khe Sanh. Both were military failures.

(U) By 1969 the situation in South Vietnam had changed considerably. Negotiations, although largely unproductive, were underway in Paris; a large scale U.S.-funded program to improve and modernize South Vietnamese armed forces (Vietnamization) was being implemented; U.S. forces were being withdrawn from the country; and the level of hostilities--measured by both number of engagements and friendly casualties--had decreased over the previous year.

(U) In the spring of 1970, a series of events in Cambodia greatly affected the military situation in South Vietnam. Prince Sihanouk was deposed by a conservative army leader and former Prime Minister, General Lon Nol. From base areas near the South Vietnamese border, the North Vietnamese Army (NVA), in conjunction with insurgent Cambodians (the Khmer Rouge), moved against the new regime, fearful that their logistic route from Sihanoukville would be closed. This action, in turn, triggered a combined U.S.-South Vietnamese strike into the Parrot's Beak and Fish Hook areas of Cambodia with the announced intention of cleaning out the NVA base areas, long a source of danger to Saigon and the rural Delta areas. These and subsequent unilateral operations by the South Vietnamese were so successful that infiltration into and enemy activity in southern South Vietnam practically ceased by the summer of 1970.

(U) In this military context, the present study examines various means of improving border security in South Vietnam, postulating continued U.S. troop withdrawals and eventual cessation of their combat operations. However, these border-security systems--and some of their social, cultural, political, and economic implications--are subject to major uncertainties (discussed below) characterizing the evolving conflict situation in South Vietnam:

CONTINUING USE OF FORCE BY NORTH VIETNAM

(U) The future of South Vietnam in general, and as related to border security in particular, rests at least partially with North Vietnam in both the political and military arenas. As long as the aims of North Vietnam remain the same--i.e., to "unify" the country under communist rule--they will continue to use force if political means are unsuccessful. The form and magnitude of the action will depend, among other things, on a time scale set by North Vietnam, the resources they are willing to commit, and on the ability of South Vietnam to resist.

PRIORITY OF INTERNAL SECURITY PROGRAM IN SOUTH VIETNAM

(U) The success of the Vietnamese Improvement and Modernization (hereafter referred to as VIM) program in producing effective military and paramilitary forces for South Vietnam will largely determine the progress in improving internal security. This, in turn, is likely to affect the numbers and kinds of forces that could be employed in a comprehensive border-security program. If internal security requires the commitment of most of the deployable combat forces for an extended period of time, their availability for an extensive border-security program would be affected and possibly of lower priority.

POLITICAL CONSTRAINTS

(U) The political situation, including any negotiated settlements, may preclude the use of Republic of Vietnam (RVN) forces in some of the border areas. *De jure* or *de facto* agreements on ceasefires, partition, coalition, or other arrangements fixing force dispositions (in place or otherwise) or limiting combat operations would possibly influence the nature and extent of border-security programs.

PERCEIVED VALUE OF BORDER SECURITY

(U) Undertaking a more comprehensive border-security program has to be weighed against the military, political, and economic costs involved. There are many reasons for attempting to counter infiltration close to the border. The political integrity of South Vietnam may be

equated by its government with territorial integrity. Permitting the enemy to control areas of the border, or yielding territory in the border areas, may be regarded as unacceptable concessions. On the military-logistic level, an effective border-security program could deny the enemy access to the South Vietnamese population and production resources necessary to the insurgency.

CONFLICT SITUATION IN NEIGHBORING COUNTRIES

(U) The political-military situation in South Vietnam will be influenced by conditions in neighboring countries. If some form of Southeast Asia area-wide settlement were to be attained, it might include withdrawal of North Vietnamese forces from Laos and Cambodia, or deny to them use of these countries as transit routes, staging areas, or sanctuaries. Under such circumstances, the major threat to South Vietnam might be infiltration or invasion across the DMZ. Such conditions could limit counter-infiltration or anti-invasion programs to that area of the border.*

(U) In light of these uncertainties, at least three broad value judgments have to be made concerning: 1) the possibility and nature of any political settlement; 2) the political aims of North Vietnam and the resultant types of infiltration threat; and 3) the progress of the improvement and modernization program for the forces of South Vietnam.

(U) Concerning the possibility or nature of a political settlement, this report assumes nothing beyond a recognition that various types of settlement are possible. Some of these, such as arrangements fixing troop dispositions or limiting military operations, could preclude the possibility or the necessity for more extensive border-security operations.

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*(C) Incursions into Cambodia by U.S. and RVN forces in the spring of 1970 might accomplish roughly the same effect; i.e., limit future major infiltration threats to the tri-border area and north. From a longer term point of view, the continued existence of an anti-Communist regime in Cambodia, especially if supported by the U.S. and its Southeast Asian Allies, should secure the southeast Cambodia border and make the northeast Cambodian border area considerably less tenable as a staging and basing area for the NVA.

(U) North Vietnam's political aims and the potential infiltration threats are discussed in Sec. III of this report. Regarding the aims of North Vietnam, we assume (as noted above) that the establishment of a unified Vietnam under Communist rule will continue to dominate. To accomplish this end, we postulate that the NVA may attempt to infiltrate at the rate of 100,000 per year. The success of these tactics in the face of a comprehensive border security program would depend on (among other things) the size of the infiltrating groups. In this study, we treat the infiltrator group-size parametrically.

(U) Progress in the South Vietnamese improvement and modernization program will depend largely on factors that cannot be easily assessed: e.g., the attitude of the Vietnamese toward the likely outcome of the war; their willingness and capability to carry out the program; the economic situation within South Vietnam; the conditions and extent of U.S. support. On the assumption that the VIM program will proceed satisfactorily despite occasional setbacks, including those resulting from enemy activities to discredit the program, an estimate has been made of the 1973 force levels of the program. In some of the major military categories, non-Communist force levels are scheduled to decrease significantly: 33 percent in maneuver battalions, 55 percent in artillery battalions, and 70 percent in attack-capable aircraft. Partially offsetting these decreases will be a 12 percent increase in Regional and Popular Forces, and a large increase in People's Self-Defense Forces. (See Sec. VI and the Appendix for a detailed discussion.)

(C) Whether under these circumstances the Republic of Vietnam can take over existing U.S. combat operations, continue the necessary internal security and pacification operations, and also be able to undertake a more comprehensive border security program will depend on a large number of conditions. On the favorable side, the improvement in internal security and pacification as reflected in recent reports could make additional forces available for border security. Conversely, increased enemy pressure, both from within the country and as a result of continuing infiltration, could present a serious threat to the capabilities of the RVN forces and the VIM program. This threat could result in some pull back of present border-security forces to reduce their vulnerability and to increase protection of the population.

SUMMARY OF IMPORTANT ASSUMPTIONS

(C) Because of the variety of possible future developments in the political and military situation in South Vietnam, several assumptions underlie this study:

1) North Vietnam will continue to pose an infiltration threat to South Vietnam. (Particular threats are described in Sec. III.)
2) North Vietnam will have access to logistic routes and bases in the border areas of Laos.
3) No political settlement will fix force dispositions or limit military operations in the border areas.

(C) Additionally, as a result of the spring 1970 military activities in Cambodia, it appears likely that, short of a compromising cease-fire agreement, the VC/NVA might have to pay a significant price to maintain their sanctuaries in southeast Cambodia and that their sanctuaries in northeast Cambodia could be considerably less secure than heretofore. These recent and fundamental changes in the nature of the war emphasize that certain portions of this study are highly sensitive to fast-moving and unpredictable events. Thus, although the present findings for Corps Tactical Zones (CTZ) I and II are probably reasonably valid, those for III and IV CTZ are highly sensitive to the long-term outcome of the conflict in Cambodia and must be evaluated in terms of several alternatives.

(C) Within these broad assumptions, the study examines some concepts and techniques for improving border security. It presupposes that internal security and pacification efforts will continue to improve despite occasional setbacks, and that progress in the VIM program will continue. But it also recognizes that major setbacks in these two related areas are likely to delay or preclude any substantial effort to improve border security.

II. THE BORDER ENVIRONMENT

(U) Border security operations are influenced by the nature of the border area of South Vietnam--its topography, vegetation, population, etc. This section provides a general description of the border area and presents data used in subsequent analyses of possible future border security operations.

(U) The land border of South Vietnam is over 1700 kilometers (1070 miles) long. Of this length, the provisional military demarcation line with North Vietnam (i.e., the DMZ) is approximately 75 kilometers, the border with Laos over 450 kilometers, and that with Cambodia over 1200 kilometers.*

(U) The material presented in this section is taken from Ref. 9, a detailed description of South Vietnam's land border prepared as part of this study. The information on topography, vegetation, and movement routes relies heavily on detailed analyses of 1:50,000 scale maps from various sources. For purposes of this study, the border zone is defined as extending from the actual border line to a depth of 10 km into South Vietnam. From the available sources of data, it appears that the 10-km zone incorporates variations in terrain and other pertinent characteristics that are representative of the area to a depth of 30 km. For convenience of organization and presentation, the border zone was divided into 107 sectors, each approximately 16-km long. Each 10 by 16 km sector was examined for topography, vegetation, and movement routes. The following summary presents the resulting compilations in an aggregated form appropriate to border security operations.

TOPOGRAPHY

(U) The topography of South Vietnam's border varies from essentially flat terrain, some of which is subject to inundation (the Delta region comprising IV CTZ and part of III CTZ), to rough terrain with

*Reference 7 describes the historical and legal aspects of these national boundaries.

steep slopes along the South Vietnam-Laos Border. Table 1 indicates the extent and percentages of various types of topography.

(U) Table 1

TOPOGRAPHY OF THE BORDER AREA (U)

Type	Length (Km)	Percent
Rough or mountainous	512	29
Rolling	496	30
Flat	300	17
Flat, subject to inundation	416	24
TOTAL	1724	100

VEGETATION

(U) The vegetation along the border is highly varied,* but can be grouped into six main types for the purposes of this study. Table 2 displays the percentage of each type.

(U) Table 2

VEGETATION OF THE BORDER AREA (U)

Type	Length (Km)	Percent
Multicanopy Forest	822	48
Single Canopy Forest	291	17
Rice Cropland	206	12
Brushwoods and Plantations	171	10
Marshlands	154	9
Dry Crop, Open Areas	34	2
Other	46	2
TOTAL	1724	100

BORDER REGIONS

(U) On the basis of topography and vegetation, South Vietnam's land border can be divided into ten reasonably homogenous regions.

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*Reference 9 classifies and discusses fifteen classes of vegetation found along the border.

Their locations are shown in Fig. 1 and their distinguishing characteristics in Table 3.

(U) Table 3

PHYSICAL CHARACTERISTICS OF THE BORDER REGIONS (U)

Region	Topography	Vegetation	Length (Km)	Remarks
1	Flat[a]	Rice cropland[a]	32	Eastern portion of DMZ.
2	Rough	Multi-canopy forest	65	Western portion of DMZ and northern border with Laos; contains Rte 9.
3	Rolling	Single-canopy forest	80	Xe Don River enters SVN at northern end and re-enters Laos near southern end of region.
4	Rough	Multi-canopy forest	435	Contains entrance (Rte 926) to A Shau Valley; extends south of tri-border point to boundary of Kontum and Dak To districts in Kontum Province.
5	Rolling	Multi-canopy forest	145	Extends south to boundary of Pleiku and Darlac Provinces; contains Ya Lop River crossing into Cambodia.
6	Rolling	Single-canopy forest	97	Extends to point just north of Darlac-Quang Duc Province boundary.
7	Rolling	Multi-canopy forest	177	Extends south to Rte 14A border crossing in Phuoc Long Province.
8	Flat	Multi-canopy forest	274	Extends south to Rte LTL 13 border crossing in Binh Long Province.
9	Flat, subject to inundation	Rice cropland and marsh	274	Extends to point just east of the Mekong River crossing from Cambodia.
10	Flat	Rice croplands	145	Extends to Gulf of Thailand; includes Mekong and Bassac River crossings.

[a]Contains a short stretch at the western end consisting of a single-canopy forested foothill transition region between the eastern coastal lowlands and the western mountains.

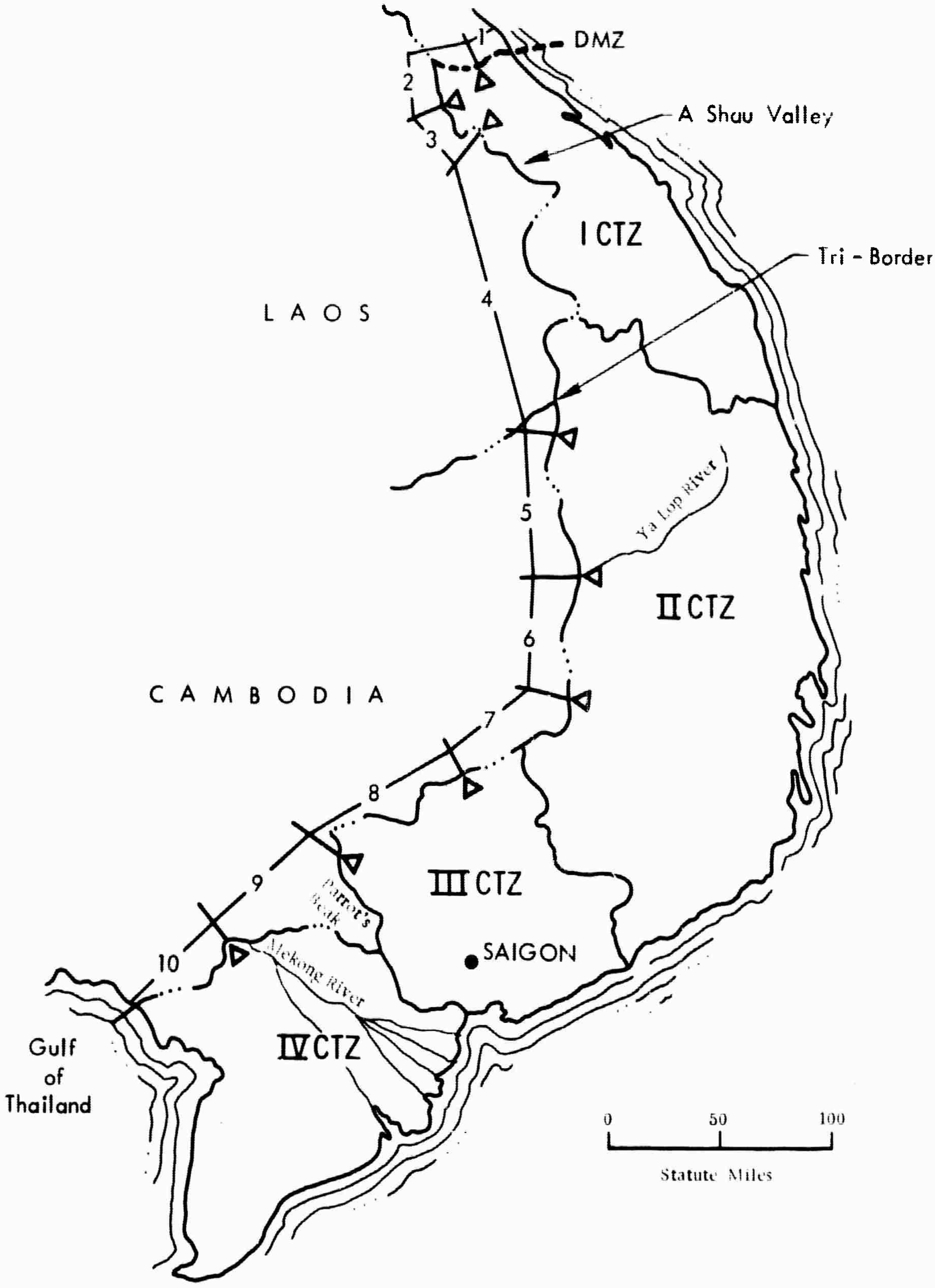

Fig. 1 — Border regions

POPULATION

(U) The population of the border area is a mixture of ethnic Vietnamese, tribal and religious groups, and Vietnamese with Cambodian backgrounds. At least ten tribes, generally referred to collectively as Montagnards, occupy the border areas of the Central Highlands. No complete population census has ever been taken in the highlands. Disruption and displacement due to the war, combined with the shifting "swidden" agricultural patterns of many tribes, introduce additional uncertainty. Recent estimates for total highland Montagnard population run from about 650,000 to 925,000.* Based on these estimates and data from the Hamlet Evaluation System,(11) the population in the border area to a distance of 10 km inside the border numbers approximately 500,000. Table 4 summarizes the population distribution by region.

(U) Table 4

POPULATION IN THE BORDER AREA (U)

Region	Population	Primary Inhabitants
1	31,000[a]	Ethnic Vietnamese
2	1,600	Tribal
3	6,500	"
4	15,200	"
5	6,700	"
6	300	"
7	15,400	"
8	10,000	Mixed
9	197,000	Ethnic Vietnamese and Cambodian Background
10	223,000	Ethnic Vietnamese and Cambodian Background
TOTAL	506,700	

[a]Includes approximately 25,000 refugees.

*See Ref. 10, Table 1, p. 25.

MOVEMENT ROUTES

(U) Crossing the border are a variety of roads, tracks and trails, as well as large and small waterways. All of these represent at least potential infiltration routes. Table 5 (based on Ref. 9) shows the number of tracks and trails crossing the border in each region. The total number, approximately 1000, is considered a low estimate since many routes are not indicated on the 1:50,000 scale maps that provide the basic source for this data.*

(U) Table 5

MOVEMENT ROUTES CROSSING THE BORDER (U)

Region	Roads	Tracks/Trails	Waterways	
			Large	Small[a]
1	3	48	0	5
2	0	48	0	5
3	2	55	0	10
4	4	103	2	1
5	1	51	3	11
6	0	19	2	9
7	0	76	0	17
8	11	101	1	9
9	13	104	15	82
10	3	43	4	107
TOTAL	37	648	27	256

[a]Permanent streams or canals less than 50 meters wide.

(U) In summary, the land border of South Vietnam is one of varied topography, vegetation, and population. Generally, the border areas at the eastern end of the DMZ and along the Delta region are flat, crop growing areas with large populations. Elsewhere, for over 1000 km,

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*(U) On the other hand, there are undoubtedly a number of confluence (or choke) points within the 10-km band, which if judiciously selected would reduce the number of "unique" trails below the identifiable number. The extent of this reduction is unknown and cannot be estimated from 1:50,000 scale maps.

the border area is generally rolling or mountainous, heavily forested, and lightly populated. The latter characterizes the entire border with Laos and the northern part of the Cambodia-South Vietnam border. Most of this portion of the border--the western side of the Central Highlands, or the edge of the Annam mountains--has been an area of heavy infiltration.

III. INFILTRATION THREATS, PAST AND POTENTIAL; CURRENT COUNTERINFILTRATION PROGRAMS

(U) The design of any program for improving border security in South Vietnam depends, among other things, on the nature of the infiltration threat. One means of estimating the nature of the threat is to review previous infiltration activities, illustrating at least the potential capabilities of North Vietnam for carrying out future infiltration. This section 1) briefly examines the enemy's infiltration operations of the past 15 years in order to establish representative "design" threats for various counter infiltration systems,* 2) summarizes border security operations in progress in the early part of 1970, and 3) gives our estimate of the future infiltration threat.

(U) The past 15 years of infiltration activities can be divided into three periods:

1) 1954-1959--during which the border areas were "relatively" peaceful;
2) 1959-1964--during which conditions along the border were unsettled;
3) 1965-1969--during which conditions along the border were openly hostile.

(U) During each of these periods, the characteristics of the infiltration differed considerably, and collectively they illustrate a range of threats. Throughout, however, the basic aim of North Vietnam has remained unchanged: to establish a unified Vietnam under Communist rule.

INFILTRATION: 1954-1959

(U) In 1954, the Geneva Agreements established a "provisional military demarcation line" roughly along the 17th Parallel. The

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*(U) In this review, emphasis is placed on activities along the land border of South Vietnam, which were only a part of the more general conflict in the country.

forces of both sides were to withdraw and "regroup" in their respective zones on either side of the demarcation line "pending the general elections which will bring about the reunification of Viet Nam."(12)

(C) Although some relocation of forces did take place, the Communists left several thousand Viet Minh political agitators and at least three experienced rifle battalions in the South with orders to remain dormant.(13) In addition, some civilian and an estimated 90,000 military personnel who were south of the 17th Parallel went to North Vietnam.(14)

> At the time Ho Chi Minh believed that . . . the rule of a united Vietnam was in his grasp. It seemed likely that the upcoming nationwide elections would turn the country over to Communist domination, if the tottering political and military forces in South Vietnam did not collapse first. In either case, attainment of the goal of unification seemed highly probable.(15)

(U) But a series of events upset these expectations. In 1954, the formation of the Southeast Asia Treaty Organization (SEATO) intensified the apprehension of the North Vietnam leadership about U.S. intentions in South Vietnam.(16) By 1955, the Government of South Vietnam, under President Diem, refused to participate in election arrangements. And North Vietnam was involved in a series of domestic crises that were not resolved by early attempts to institute land reform; these apparently undermined Ho's confidence about the outcome of the elections even if held.

(U) With hopes of an early collapse of South Vietnam fading, and with the possibilities of unifying Vietnam by elections seemingly gone, North Vietnam apparently decided to embark on a campaign of organizing increased political opposition to the government of South Vietnam. To assist in the organization of such a campaign, North Vietnam started to infiltrate political agitators, and intelligence, propaganda, and terrorist teams into South Vietnam. Most of these early infiltrators were "regroupees," i.e., individuals who had gone to North Vietnam under the Geneva Agreements. Many had served with the Viet Minh during the war.

(C) As the organizing cadre for the political and terrorist operations against the government of South Vietnam, the original

infiltrators were largely hand-picked individuals who entered the south individually or in small groups and moved into some of the former Viet Minh base areas located in remote regions of the country. Some of the early regroupees infiltrated South Vietnam by sea; others crossed the Demilitarized Zone (DMZ), or skirted its western end and entered through Laos.*

(C) Throughout the 1954-1959 period, infiltration of individuals or small units of regroupees continued. As the Diem regime instituted programs, particularly in the urban areas, to curtail the activities of anti-government groups in South Vietnam, and as U.S. military assistance advisory and economic support to South Vietnam increased, North Vietnam infiltrated not only political organizers, armed propaganda teams, and other personnel into South Vietnam, but also cadres to organize the military units of the Viet Cong.

(C) South Vietnam made no major attempt to prevent infiltration during this period. The land border, with the exception of the DMZ, was open to relatively free movement of civilian traffic and to infiltrators.

(C) Infiltration during the 1954-1959 period can be generally characterized as follows:

1) North Vietnam sent personnel, almost exclusively regroupees, into South Vietnam with the primary mission of organizing political and military forces for opposing the existing government of South Vietnam.
2) The infiltrators came either individually or in small groups.
3) The infiltrators used a limited number of land routes primarily across or skirting the western end of the DMZ.
4) The infiltration was covert although there was virtually no opposition to border crossing.

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*(U) Little available data exists on the total number of these early infiltrators or on the specific infiltration routes they used.

INFILTRATION: 1959-1964

(U) The second period of infiltration represented a shift from an organizing period to one of active support of the insurgents. At least three major changes took place during this period:

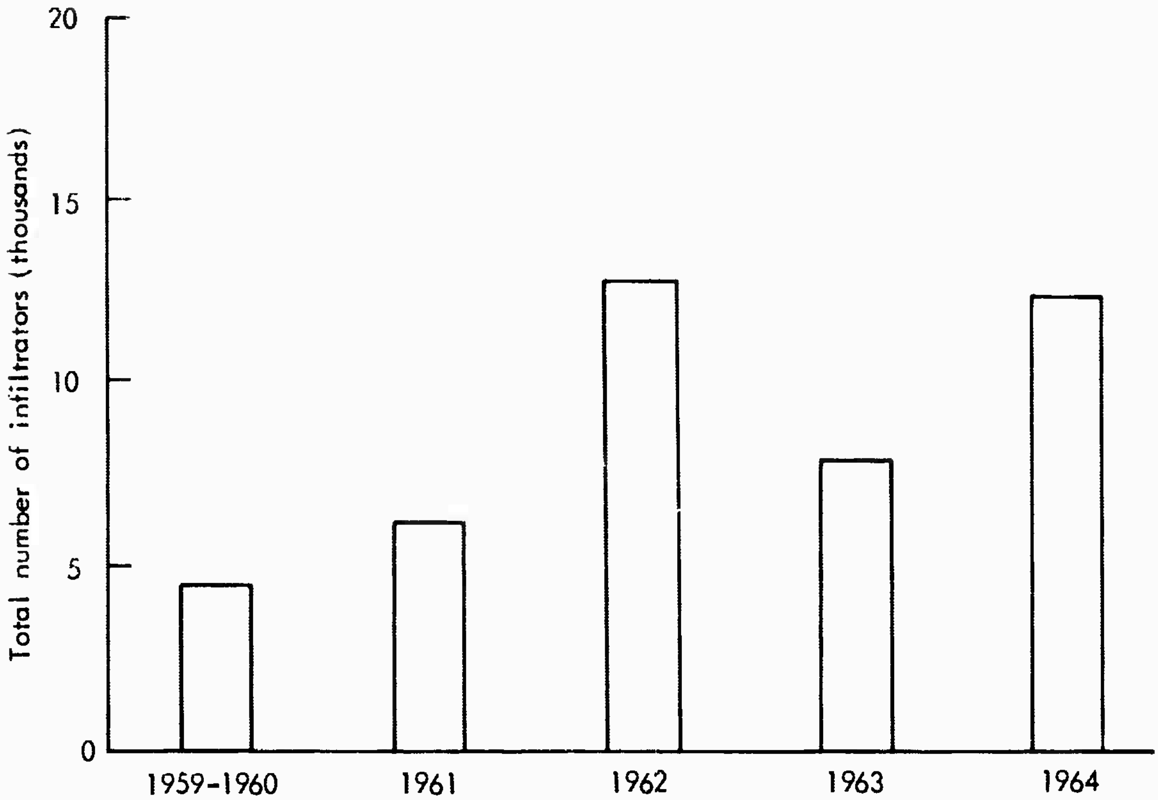
1) North Vietnam established the National Liberation Front (NLF) of South Vietnam, whose ten point program called for the overthrow of the Saigon government.

2) North Vietnam opened major logistics routes to South Vietnam via Laos and Cambodia.

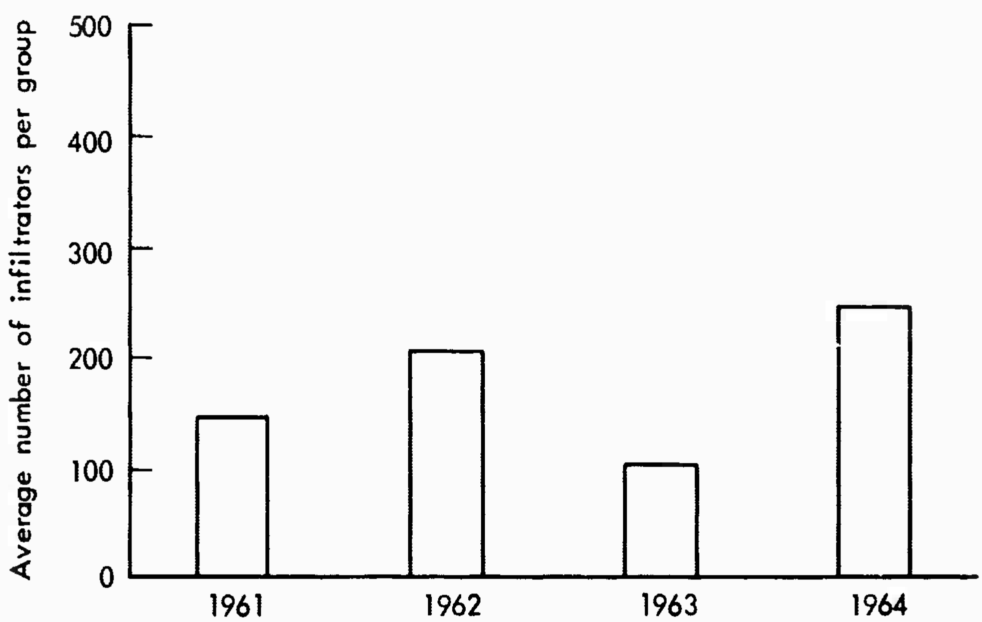
3) Using these routes, North Vietnam increased the number of infiltrators and also started the large-scale delivery of arms and supplies to South Vietnam.

(C) Although the establishment of the NLF was announced in 1960, as early as 1959 North Vietnam had actively supported communist forces in Laos (the Pathet Lao) in efforts to secure the area of Southern Laos contiguous to the border of Vietnam. By late 1959, the 70th Transportation Group (later, a part of the 559th Transportation Division) moved into the secured areas of Laos to establish a chain of "communication-liaison-transportation" stations along trails connecting North Vietnam to South Vietnam via Laos.

(C) This complex of trails was part of the Ho Chi Minh Trail system that also included the truck routes used later to move arms and supplies to the Viet Cong. With the availability of the trail system, infiltration during this period reached the levels shown in Fig. 2. The infiltrators were still predominantly regroupees, but emphasis was on military support of the insurgency. As a result of the growing pressure from the Viet Cong, bolstered by the increasing number of infiltrators, South Vietnam gave up control of some of the populated areas. This shift in activity from organization and propaganda to more direct military support of the Viet Cong, and the resulting military successes, forced the government of South Vietnam to place increased emphasis on internal security.



(C) Fig. 2 — Infiltration levels, 1959-1964[2] (U)



(C) Fig. 3 — Average size of infiltration groups: 1961-1964[2] (U)

(C) Not only did the level of infiltration increase between 1959 and 1964, but the availability of the Ho Chi Minh Trail made it possible for larger-sized infiltration groups to move south. (Figure 3 shows the average size of the groups for the 1961-1964 period.) In addition, the entry points of infiltration extended along a greater length of the border. By 1961, groups were entering South Vietnam from Cambodia after travelling overland through Laos.

(C) Increased military activity in South Vietnam resulting from larger numbers of infiltrators entering in larger units over a greater length of the border contributed to a growing concern with the infiltration threat. By 1962, concurrent with the Strategic Hamlet Program to protect hamlets from Viet Cong attack, U.S. Special Forces undertook the task of training local militia and Civilian Irregular Defense Groups (CIDG) to screen the border. Early efforts were restricted to ethnic minority groups (Montagnards) of the Central Highlands area. The original concept was to use Special Forces "to recruit, train, and utilize personnel familiar with the terrain for surveillance along the Cambodian and Laotian borders."[17] In retrospect, it also appears that the creation of the CIDG was a convenient vehicle for permitting minority groups to fight the Communists, albeit in a semi-autonomous way.

(U) By mid-1963, over 20 camps for Special Forces/CIDG units had been established. Additional camps continued to be set up and the mission of the forces was expanded to include operations to disrupt infiltration. As the number of camps increased, armed clashes between the CIDG and infiltrators occurred and some of the camps came under direct attack.

(C) Infiltration during the 1959-1964 period can be generally characterized as follows:

1) North Vietnam sent personnel, primarily regroupees, into South Vietnam to actively support Viet Cong military activities. The missions of the infiltrators included not only organizing and training Viet Cong forces but also participating in combat operations.

2) The total level of infiltration increased, and infiltration groups averaged about 150-200 men per group.
3) North Vietnam began to move arms and supplies by truck via the Ho Chi Minh Trail through Laos to South Vietnam.
4) Personnel infiltration routes were extended south through Laos and Cambodia, flanking South Vietnam, and eventually culminating in convenient, well-defended entry points.
5) The creation of Special Forces/CIDG camps for border surveillance and for the conduct of operations against infiltrators led to armed clashes in the border area.
6) Involved with internal security operations, South Vietnam was unwilling or unable to establish a comprehensive counterinfiltration program along the land border.

INFILTRATION: 1965-1969

(C) The third period of infiltration was marked by several changes:
1) The introduction of regular units of the North Vietnamese Army into South Vietnam.
2) A sharp increase in the number of infiltrators and in the size of the infiltration units.
3) Active military operations against U.S. military forces in South Vietnam.

(C) By late 1964, North Vietnam apparently believed that Viet Cong operations had weakened South Vietnam, but that political and military activities were unable to bring about the collapse of the government, the destruction of the Army of South Vietnam (ARVN), or a popular revolt in the country.* In any event, North Vietnam decided

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*(U) Or, spurred by the possibility of U.S. intervention following the Tonkin Bay naval encounters of August 1964, North Vietnam may have decided to defeat ARVN and bring down the GVN before the U.S. could act effectively.

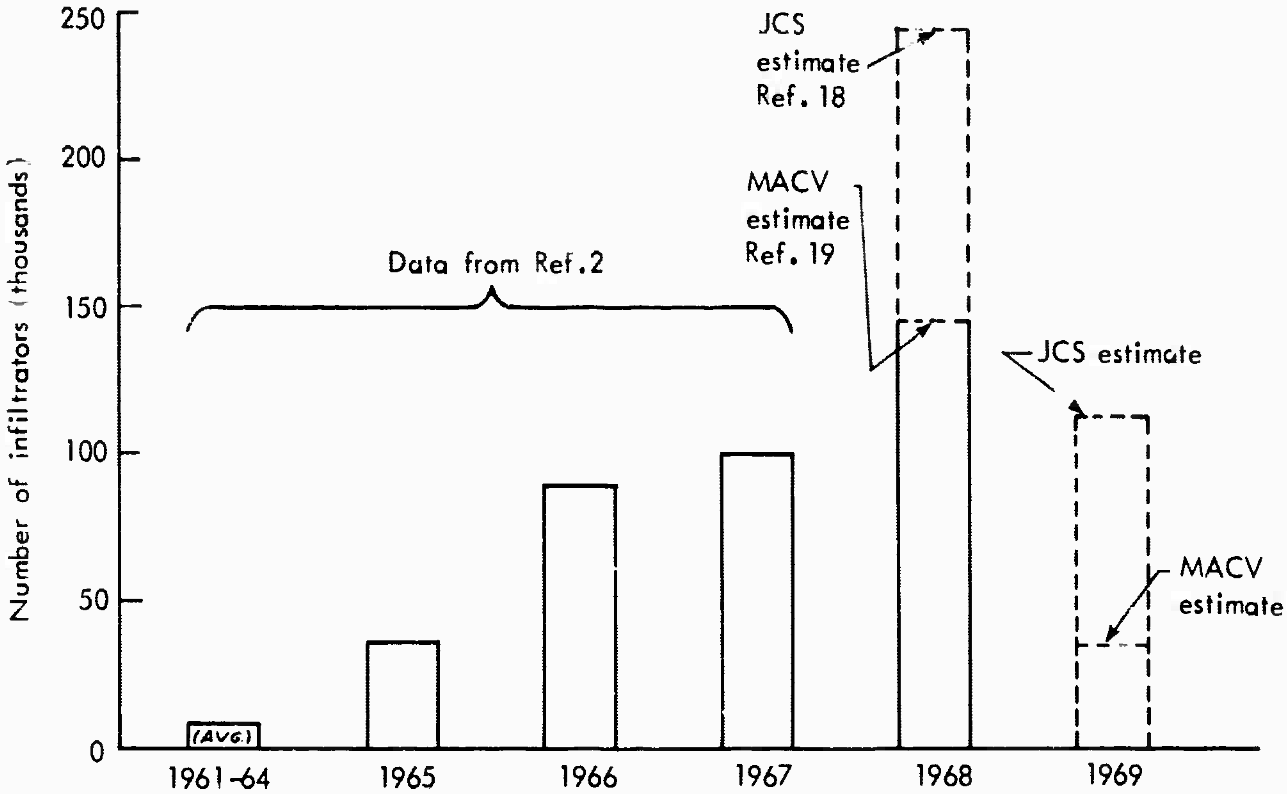
upon direct participation in the war. The first regular units of the North Vietnamese Army (NVA) entered South Vietnam in December 1964. From that time through 1968, the number of infiltration units and the size of the units increased sharply. Figure 4 displays the data on the number of infiltrators; and Fig. 5, on the average size of the infiltration units.

(C) As during the 1959-1964 period, the network of infiltration routes to support the higher levels of infiltration and supply movement was further expanded. By 1968 infiltration was occurring over most of the length of the border, with different areas subject to varying degrees of infiltration. Figure 6 presents a composite picture of the estimated percent of infiltration during 1967-1968 for each of the 10 regions described in Sec. II. Infiltrators were using an estimated 200 popular (i.e., frequently used) routes across the border of South Vietnam.

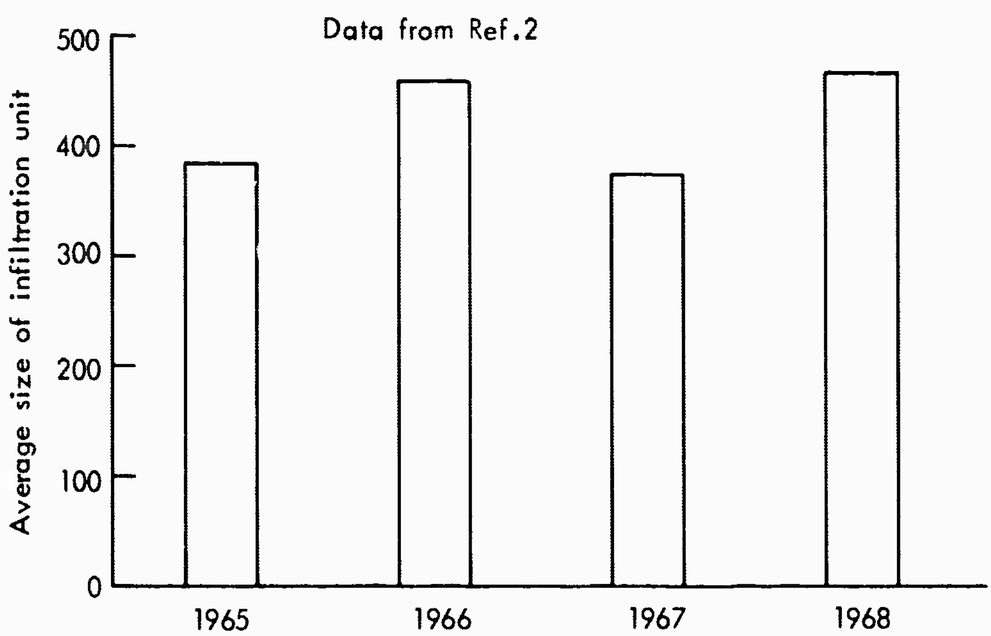
(C) During the 1965-1968 period, NVA units, separately or in conjunction with Viet Cong forces, engaged in combat with U.S. and ARVN forces. The active participation of North Vietnam in the conflict, both in sending arms and supplies down the Ho Chi Minh Trail, and in combat operations, resulted in greater emphasis on efforts to counter the infiltration of men and supplies. During this period, the U.S. initiated air operations against targets in North Vietnam and Laos, and air, ground, and naval operations in the border areas (described below). Despite these efforts, the infiltration of personnel into South Vietnam increased through 1968. Heavy NVA combat losses, however, kept the total NVA combat strength in South Vietnam below 110,000 (including NVA personnel in VC units), the high point being reached in June 1968.[19]

(C) Infiltration during the 1965-1968 period can be generally characterized as follows:

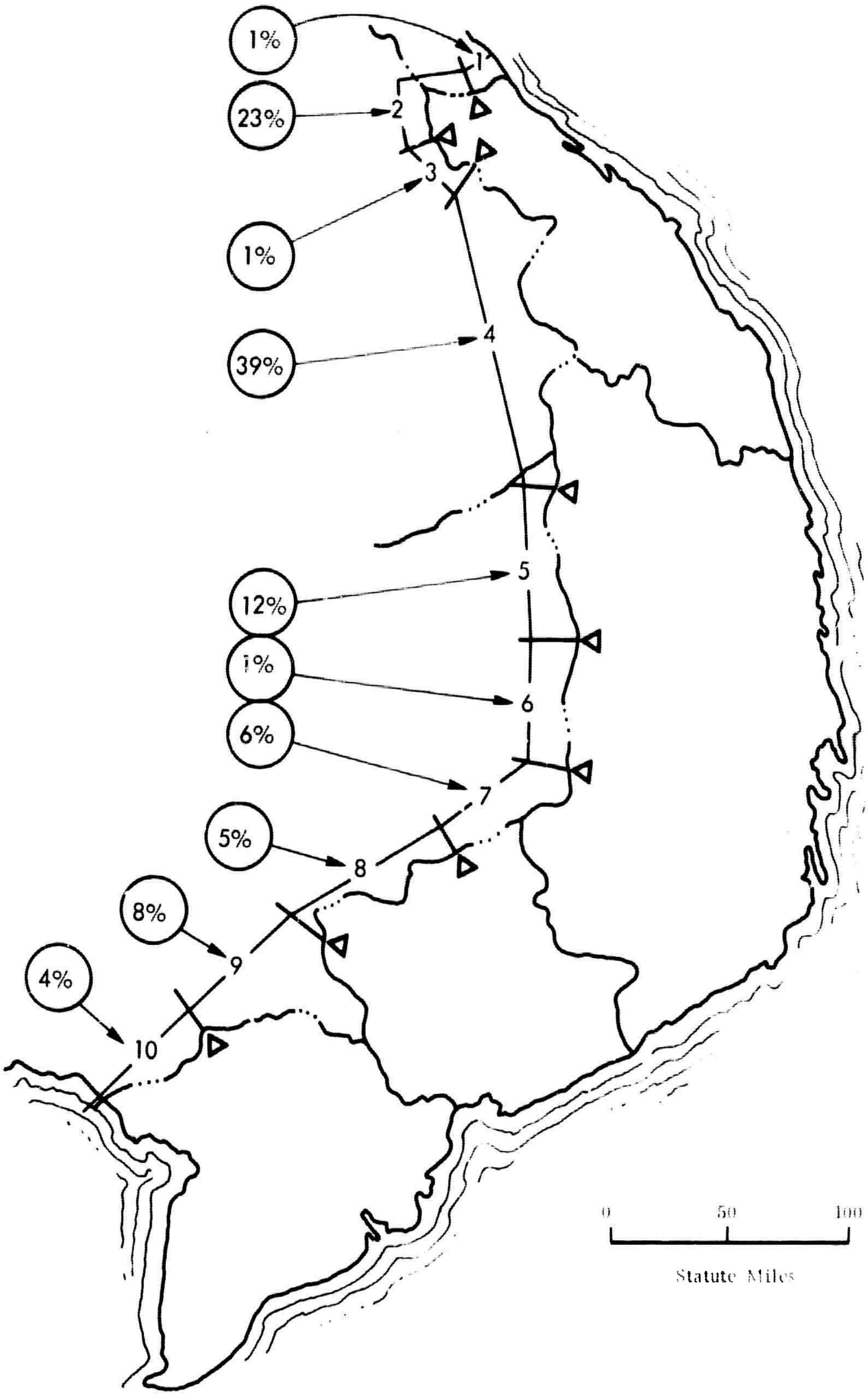
1) North Vietnam became a direct participant in the conflict, sending regular NVA units, arms, and supplies into South Vietnam. The mission of the NVA was to engage in combat operations both in support of the Viet Cong and independently.



(C) Fig. 4 — Infiltration level, decade of 1960's (U)



(C) Fig. 5 — Average size of infiltration unit (1965-1968) (U)



(S) Fig. 6 —Estimated percent of infiltration by region (U)

2) the total level of infiltration and the average size of the infiltrating units rose sharply.

3) Infiltrators used routes into South Vietnam along the entire length of the land border.

(C) The developments described above show that North Vietnam already has had experience with a wide range of infiltration modes. Therefore, many possible combinations of group size, types of infiltration, infiltration tactics, etc. can be considered as threats for the future. We have selected several of these combinations for analysis, but recognize that, at best, they are only some of the many possible. Furthermore, the likelihood of their implementation will be influenced by the scope and type of border defenses installed to counteract them. Techniques and defenses employed to counter infiltration during the period 1967-1969 are described on the following pages.

CURRENT BORDER SECURITY OPERATIONS

(S) During the period 1967-1969, border security received an increasing share of the total military effort in South Vietnam. Factors contributing to this increased attention included:

1) An improved internal security situation made it possible to consider the use of some forces for operations in areas closer to the border.

2) Some large enemy units, particularly those of the North Vietnamese Army (NVA), withdrew into sanctuaries across the borders of Laos and Cambodia, or in some cases into remote bases along the border of South Vietnam.

3) The development, primarily by the Defense Communication Planning Group (DCPG), of detection devices (including remotely emplaced sensors and associated relay and readout equipment) has provided improved surveillance capabilities to the forces in Southeast Asia. Originally used primarily for monitoring enemy truck routes in Laos (the Igloo White operation), these devices contributed to the

military defeat of the enemy at Khe Sanh in 1968, and are being used on an increasingly large scale for a variety of missions within South Vietnam (the Duffel Bag program), including detection of infiltration.

(U) To provide a perspective on border security operations, this section presents a brief description of early-1970 activities that contributed to border security. The description predates the US-ARVN incursions into Cambodia in the spring and summer of 1970. As a result of those actions, the details of the border defenses have changed significantly and perhaps permanently. The perspective supplied therefore must be viewed in its historical context, the main points being that as internal security improved and as technological capabilities increased, border security increased in importance.

(C) The early 1970 "border" could be considered to consist of a line contiguous to a series of enemy enclaves on the international boundary. A very rough estimate, based on plotting the locations of Communist base areas encroaching on South Vietnamese territory, indicates that as much as 25 percent of the national border was then controlled by the NVA or the Viet Cong (VC). As implied above, this percentage has probably been significantly reduced by subsequent operations--particularly along the SE Cambodian border.

(C) The "out-country" operations, i.e., those conducted outside of the present border, included surveillance of the infiltration routes through Laos and air attacks on both the routes and the vehicles using them. The operations involved airborne surveillance using visual, infrared, and electromagnetic means as well as remotely emplaced sensors covering known or suspected routes and facilities (e.g., truck parks). The sensor activations were relayed via aircraft (EC-121R) to the USAF Task Force Alpha, Nakhon Phanom, Thailand, for intelligence evaluation and for developing targets for air attack. The airborne surveillance also produced potential targets for air strikes. The command and control

center* had the task of sorting out target nominations from all sources and matching available strike resources to them according to 7th Air Force/MACV priority guidelines. Finally, a small number of gunships (having a self-contained surveillance and strike capability) was interspersed among the other surveillance and strike operations.

(C) Portions of the tactical context in Laos have been relatively favorable for this kind of campaign against enemy vehicles and routes. For example, enemy truck traffic on the routes through Laos, collectively called the Ho Chi Minh trail, is in sparsely populated areas, permitting pervasive air strike operations. Nevertheless, although vehicles and road building or repair activities are often detected and attacked, the concealment provided by jungle canopy throughout much of the area, and the large number of roads and trails, have importantly affected the ability of air operations to target much of the truck traffic and the bulk of the personnel infiltration on foot.

(S) The "in-country" operations, either directly concerned with or related to border security, are shown schematically in Fig. 7. This figure greatly simplifies the situation, particularly with respect to the organizational structure of the operations. It identifies the four ARVN Corps Headquarters that are the overall coordinating agencies for RVN military operations in their respective areas of responsibility. (In some cases, the corps commanders delegate responsibility for operations in the border area to local commanders.) Each Corps Headquarters has its own Direct Air Support Center (DASC) for air operations, colocated with its Tactical Operations Center (TOC) for ground operations.**

(S) Without going into detail, the following descriptions characterize the type of border security operations conducted in each major geographical area.

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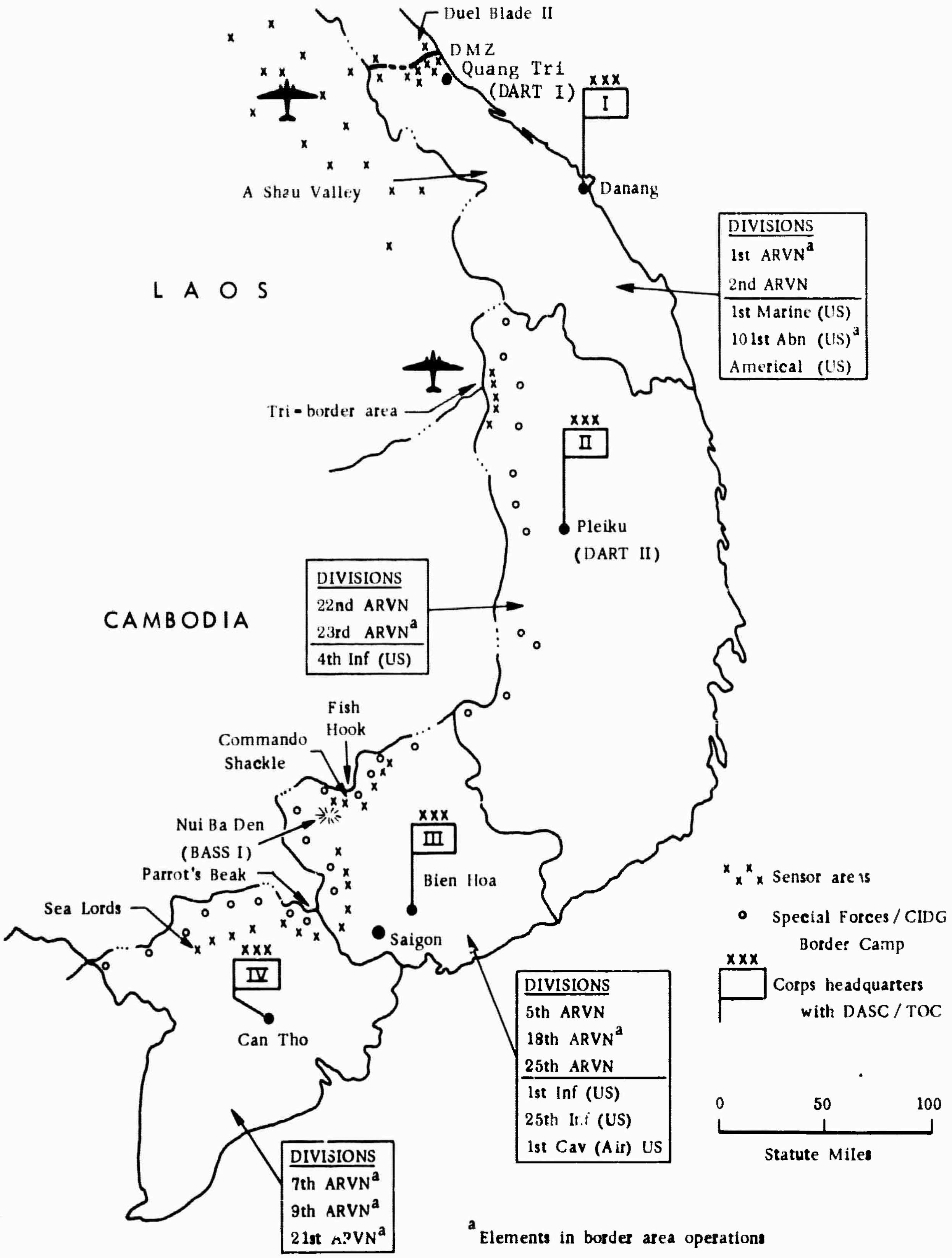
*(C) This function was performed by an airborne command and control center near the operational area or from Task Force Alpha (TFA) operations. Both were in fact forward echelons of the 7th AF Tactical Air Control Center (TACC) at Tan Son Nhut.

**(S) The DASC and TOC have been jointly manned by RVN and U.S. personnel. Figure 7 does not indicate the command relations for U.S. forces in South Vietnam and the command relations between RVN and U.S. forces.



(S) Fig. 7 — Schematic of early-1970 border security activities (U)

Demilitarized Zone

(S) The DMZ has been a priority area in the defense of South Vietnam since it represents the most direct route for infiltration or invasion from North Vietnam. The most important early-1970 border security operation in the area was the Duel Blade II program. Duel Blade II consists of a series of interlocking defense positions along the eastern part of the DMZ. These positions or strong points with their associated obstacles represent the forward element of a mobile defense system that can draw on other troops in I CTZ for support if faced with large-scale attacks.

(S) Duel Blade II operations include: frequent ground patrolling and sweeps of areas of responsibility; and employment of various types of acoustic, seismic, and other remotely emplaced sensors, as well as night observation devices (NOD), starlight scopes (SLS), anti-personnel radar, etc. Some of the remote sensors are air emplaced in the DMZ and others are hand emplaced in immediate proximity to the Duel Blade II installations. Aircraft of Task Force Alpha do the air emplacement and also relay sensor data. Read-out is at a Tactical Surveillance Center (TSC), which integrates this information with some of the local sensor information as well as with intelligence from other sources. The TSC analyzes and disseminates the information to local units for exploitation. Primary ways of reacting are with artillery and ground troops with air support as required and available. With the withdrawal of U.S. Marine units from the DMZ area, the ARVN 1st Division has taken over some of the operations and has used some remote sensors.

(S) In addition to this more permanent type of border security operation, patrols have been dispatched to other border areas of I CTZ, including the western areas of the DMZ and the A Shau Valley near the border with Laos, south of the DMZ. Heavy air strikes have also been used. U.S. Marine and Army forces and ARVN units have also made multi-battalion sweeps through these areas, which contain major infiltration routes. Extension of the Duel Blade II concept, including use of emplaced sensors, to the western portion of the DMZ and south to the A Shau Valley is part of the Tight Jaw program of U.S.

Military Assistance Command, Vietnam (MACV) to counter infiltration through these areas.

Central Highlands

(C) Prior to 1967, most screening operations in the Central Highlands were conducted by Special Forces/CIDG personnel located in border-area camps. Eleven camps, situated at various distances from the border, had responsibilities that included border surveillance and reaction, primarily by artillery or ground units. Elements of the U.S. 4th Infantry Division and ARVN units, including some elements of the ARVN 23rd Division, were also involved in border security operations.

(S) By the early part of 1970, surveillance of the tri-border area (juncture of South Vietnam, Laos, and Cambodia) was augmented by the use of air-emplaced sensors. Information was relayed by EC-121R aircraft to a terminal facility at Pleiku. This facility, the Deployable Automatic Relay Terminal (DART II), monitored the sensors and disseminated the information to appropriate reaction units, or initiated air surveillance of suspected areas of enemy movement. This information also contributed to the general intelligence picture of enemy activity in the Central Highlands.

Approaches to Saigon

(C) This area includes the section of the Cambodian border that projects deeply into South Vietnam, toward Saigon, called the Parrot's Beak (Fig. 7). Prior to the U.S.-ARVN incursions into Cambodia in 1970, it had been an area of continuing enemy infiltration and base development. Because of the proximity of the border to the capital, about 50 kilometers at the closest point, the area was very highly defended. Border security activities included air, riverine, ground, and sensor surveillance. Reaction capabilities included artillery, ground patrols and sweeps, air strikes, and armed water craft.

(S) Early in 1970 the units in the border area included elements of the U.S. 1st Division (Airmobile) and the U.S. 25th Infantry Division, RF/PF units, a number of artillery fire-support bases (FSB),

about 16 Special Forces/CIDG camps, and units of the U.S. Navy SEA LORDS operation (Southeast Asia, Lake, Ocean, River, Delta Strategy). These units were supported by air and helicopter operations, which provided strikes as required.

(S) In addition to normal patrol, sweep, and other operations, some of these units used emplaced sensors to increase their surveillance and targeting capabilities. Sensors are used by local units that emplace and read out information directly. They are also used with a number of systems in which information is relayed to central locations for dissemination to appropriate air, ground, and naval units:

a) The Battlefield Air Surveillance System (BASS 1), which relays information to read-out facilities of the U.S. 25th Infantry Division.

b) The U.S. Navy SEALORDS operation, which use SEA LORDS Vans (SLV) to disseminate information to appropriate naval, artillery, and other units.

(C) In general, the defense of the Saigon area represents the classical multiple-screen pattern of military defense. In and near the border area, ground patrols, riverine craft, fire support bases, RF/PF units, and Special Forces/CIDG camps provide a forward screening force. Using a variety of surveillance devices including emplaced sensors, they are capable of reacting to some local enemy intrusions. They are supported by additional fire and maneuver forces (artillery and infantry battalions), armed helicopters, and tactical aircraft. A third echelon of ground forces and other units in the vicinity of Saigon are available as reserves in the event of a large-scale enemy attack.

Delta

(C) The Delta is particularly important to South Vietnam because it contains a large part of the population and produces a significant fraction of the rice used in the country. Border security operations are complicated by the large number of interlaced canals and streams

throughout the area and by the channels of the Bassac and Mekong Rivers, the latter carrying ocean traffic to Phnom Penh, Cambodia. The population in the area has traditionally moved freely across the border with little regard to customs and immigration rules.

(C) Security operations in the border area of the Delta include ground, naval, and air operations. The RVN forces are primarily responsible for ground operations. The border area contains Special Forces/CIDG camps and ARVN bases, which provide artillery coverage of a large part of the border area and from which are conducted patrols and sweep operations supported by air strikes (when required).

(S) United States naval and riverine operations (turned over to the Vietnamese Navy in the spring of 1970) involve extensive patrolling of the waterways with various types of watercraft including assault patrol boats. Both ground and naval operations are aided by a curfew that in many areas makes the waterways "free fire" zones during the hours of darkness. In support of the various operations of the naval forces, including the overall SEALORDS operations and its sub-operations (Giant Slingshot, Barrier Reef, etc.), remotely emplaced sensors are used extensively. In addition, RF/PF units conduct patrols and cooperate with other forces in sweep operations.

FUTURE INFILTRATION THREATS

(U) Any estimate of the amount or nature of future enemy infiltration involves not only the extent to which North Vietnam will pursue its aim of Communist rule over South Vietnam, but also the manner in which they may prosecute the war, including their estimate of the progress of the VIM program, the efficiency of border defense, and U.S. commitments. In addition, such factors as the amount of Soviet and Chinese Communist support must enter into an estimate of future infiltration.

(C) Armed penetration into I and II CTZs will remain a real threat. Considering the success of previous efforts against sophisticated defenses, the threat of infiltration or armed invasion will not disappear over the next several years. Even if some form of settlement is reached, any government of an independent South Vietnam

will recognize that North Vietnam poses at least a potential threat. Thus, some form of counter-infiltration or counter-invasion capability will be maintained. The DMZ is likely to remain a defended area, and some forces will be retained throughout the country as general reserves.

(S) In light of these factors, a variety of threats can be postulated, all of which would depend heavily on important assumptions concerning enemy intentions. Those assumptions that conditioned our choice of threat scenarios include the following alternative possibilities:

1) The war will continue either overtly or covertly. The government of North Vietnam will attempt to maintain (or occasionally step up) pressures in South Vietnam as the U.S. withdrawal continues. The enemy will seek to expand its control in South Vietnam with the expectation that NVA and VC forces can eventually defeat the South Vietnamese forces or provoke a favorable settlement. Under these circumstances, infiltration of regular NVA units and supplies will continue perhaps at a level typical of 1969.

2) The intensity of the war will decrease. North Vietnam will revert to a force posture somewhat typical of the 1960-1964 period. It will infiltrate selected and smaller groups of personnel. These will be primarily replacements for losses, specialized military units such as sappers, and political agents to support VC programs. The minimal objective will be to sustain the VC movement and to prevent improved RVN forces from clearing out some of the areas presently held by VC or NVA forces. This scaling down of the intensity of the formal war will permit expansion of terrorist activities, with the objective of eventually forcing the government of South Vietnam to make

political concessions in the form of a coalition government, a de facto or de jure partition of the country, or some other relatively favorable settlement.

(C) On the basis of these assumed enemy options, we have postulated three types of infiltration threats. None of the threats include a quick offensive strike by North Vietnam in the form of a coordinated attack across the border.

Threat Type I

(C) This is considered the low threat. It assumes that North Vietnam will concentrate on terrorism, assassinations, and minimum support of the insurgency. The support will be primarily the infiltration of political personnel and small specialized military units as replacements or for specific missions. General threat characteristics would be:

1) Infiltration of units of 3-12 individuals (average of 6).

2) The infiltrators could come across the border at almost any point, excluding those areas south of the Parrot's Beak; i.e., only routes and bases in Laos and Northeast Cambodia would be available to North Vietnam. (The Parrot's Beak as a dividing point for the infiltration has been selected as a rough approximation. An equally acceptable division point would be the Fish Hook. This would make threats I and II even less severe than postulated.)

3) The infiltration would be covert; i.e., infiltrators would try to avoid contact with RVN forces, and would fight only if ambushed. Even under these circumstances, they would try to minimize their losses and withdraw rather than sustain heavy casualties. They would also move primarily at night.

Threat Type II

(C) This is considered a moderate threat. It assumes that North Vietnam will continue to support the insurgency by providing replacement personnel and special units. General characteristics would be:

1) Infiltration of units of 20-60 (average of 40), including platoons or reduced companies of NVA.
2) The infiltrators could come across the border at almost any point, as above, excluding those areas south of the Parrot's Beak.
3) The infiltration would be as covert as possible, but the units would engage RVN forces if the military situation seemed favorable; i.e., they would not withdraw if contact was made.
4) Infiltration would take place either during the day (in remote areas) or at night.

Threat Type III

(C) This is considered a severe threat. It would represent essentially the early 1970 situation. General characteristics would be:

1) Infiltration units of 100-1000 troops (average of 400, or approximately a battalion).
2) The infiltrators would be regular NVA units.
3) The infiltrators could come across the border at almost any point since transit and bases in Laos and Cambodia would be available. (Reversion of the situation in Cambodia to those conditions prior to the Lon Nol regime is assumed.)
4) Infiltrators would engage mobile defense forces if contact was made but would not deliberately attack border-control posts and bases.
5) Compared to the other threat types, the infiltration would be overt; although lacking overall numerical and air superiority, the NVA would continue to choose their engagements with care.

(U) Table 6 schematizes the three threat types.

(U) Table 6

CHARACTERISTICS OF POSTULATED INFILTRATION THREATS (U)

Threat Type	Mission	Infiltrator Group Size[a]	Routes[b]	Tactic	Response to Contacts[c]
I	Terrorism, organization, and limited support	3-12 (6)	~500	Covert penetration, night	Withdraw
II	Support VC, replace losses	20-80 (40)	~500	Covert penetration, day or night	Withdraw or engage
III	Maintain combat strength in SVN, engage RVN/US forces	100-1000 (400)	~1000	Overt penetration, day or night	Engage

[a]Figures in parenthesis are averages assumed for subsequent calculations.

[b]Assumes all routes shown in Table 5 are potential infiltration routes. For Threats I and II, Regions 9-10 are excluded.

[c]Engaging of defense forces is assumed to occur if enemy considers situation favorable or engagement is unavoidable as in an ambush.

(C) Three additional aspects of the above postulated threats should be noted:

1) If an engagement occurs, the extent to which the enemy will continue to fight depends on the degree to which he is determined to infiltrate successfully. For this complex aspect of infiltration we have coined the simplified term "resolve." Defined as the percent casualties that an infiltrating unit will sustain before breaking off an engagement, resolve is further discussed in subsequent evaluations of border security system effectiveness (see Sec. V).

2) The threats are regarded as infiltration threats. They are not intended to include situations in which an enemy battalion attacks a defense installation. Thus, for example, they do not include a deliberately planned attack on a fire-support base. This arbitrary distinction is made for analytic purposes. It means that a 400-man unit crossing the border area is regarded as an infiltrating force, but that if it enters the country and then decides to attack a defense installation it becomes part of the internal security problem and is no longer considered to be infiltrating.

3) Although the three threat types are presented separately, it is recognized that a mixture of threats can occur at any time.

IV. ENHANCED BORDER SURVEILLANCE

(C) The primary emphasis of this report is on passive border security.* Border security, defined as preventing unauthorized crossing of border areas, is regarded as consisting of two related activities: 1) surveillance to detect unauthorized crossers; 2) interdiction of crossers--i.e., killing, disabling, capturing, harassing, or any other activity that stops infiltration attempts. The border area is herein defined as that area whose forward edge is either the national border or a line roughly contiguous to areas under enemy control, and whose rear edge is at some variable distance (10-20 km) behind the border depending on the section being considered. As indicated in Sec. III, a number of different types of operations are being conducted in the border areas of South Vietnam that can be considered border security operations; i.e., they involve both surveillance and interdiction activities. Generally, improved border security requires increased capabilities for both activities.

(C) This section considers means of enhancing border surveillance. However, it considers only those means that do not require a substantial redeployment of RVN forces to the border area either prior to U.S. withdrawal or shortly thereafter. The redeployment of ARVN or other RVN forces taking over U.S. operations will take place, for the most part, outside the context of border operations. (Section V will consider means of improving border security where such forces are redeployed to the border.)

(S) As of early 1970, border surveillance included a variety of means: air reconnaissance; ground, riverine, and naval patrols; large-unit ground sweeps; the use of remotely emplaced sensors, etc. As indicated above (Sec. III), the scale of these activities varied in

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*(U) We make a distinction between active and passive border security. Active border security implies armed pre-emptive incursion or hot pursuit across a border by its defenders. Although it is possible (and even likely) that active border security will become the mode in South Vietnam (given the events of spring and summer 1970), we exclude such activities in this study.

different border areas. The primary means for enhancing border surveillance without redeployment of forces is a more extensive use of available technology--i.e., increasing the numbers and types of sensors--which, in turn, requires more extensive data-relay, information-processing, and targeting facilities.

(S) In early 1970, approximately 1300 remotely emplaced sensors were employed in the border areas.* Table 7 shows the estimated numbers in each of the four Corps Tactical Zones (CTZs), including various types of emplaced sensors (seismic, acoustic, etc.) whose main function is to monitor activities in areas of current or suspected infiltration.

(S) Table 7

ESTIMATED NUMBER OF EMPLACED SENSORS IN BORDER SURVEILLANCE PER CTZ (U)

Corps Tactical Zone	Number of Sensors[a]
I	250
II	200
III	500
IV	350

[a]Includes only those sensors in the border area.

(C) A program that expanded the use of sensors to all routes capable of being traversed would be one means of enhancing border surveillance. How many routes this would involve is not clear. Table 5 (p. 14) provides a basis for an approximation since it includes a count of all routes crossing South Vietnam's border. At best, however, this is a rough estimate for several reasons. Not all routes are easily accessible to the enemy without shifts in his pattern of

*(C) This number is an estimate since it is difficult to attribute some sensor uses directly to border surveillance, and because the number and location of active emplaced sensors varies continually. According to DCPG sources, almost 5000 sensors were in use throughout all of South Vietnam at the beginning of 1970.

infiltration. In addition, some routes might be considerably less desirable than others because of terrain. Finally, it is likely that some routes converge to choke points not identifiable on our 1:50,000 scale maps but known to local defenders.

(U) On the other hand, all of the routes indicated in Table 5 are potential movement routes. It is to be expected that the enemy will try to find alternatives after encountering routes covered by sensors and will shift to other potential routes. Table 8 shows the number of routes in each CTZ (based on the data in Sec. II). In subsequent discussions these are called identified routes.

(U) Table 8

NUMBER OF IDENTIFIED MOVEMENT ROUTES CROSSING BORDER (U)

Estimated Number of Movement Routes					
CTZ	Trails/ Tracks	Roads	Waterways Large	Waterways Small	Total
Threats I and II					
I	248	9	2	21	280
II	141	1	5	26	173
III	92	5	0	9	106
IV	0	0	0	0	0
Total	481	15	7	56	559
Threat III					
I	248	9	2	21	280
II	141	1	5	26	173
III	142	17	2	34[a]	195
IV	117	10	18	175[a]	320
Total	648	37	27	256[a]	968

[a]During the monsoon season, the vast bulk of border terrain south of the Parrot's Beak is completely inundated. Therefore, our definition of small waterway applies only to the dry season.

(U) In accordance with our definitions of various infiltration threats (Sec. III), the total number of movement routes crossing the border varies from about 500 for the low threats to about 1000 for the high threat. The latter implies, of course, restoration of conditions in Cambodia to those prevailing prior to the overthrow of Prince Sihanouk. Such a condition would not be incompatible with a revitalized and strengthened NVA capable of infiltrating into South Vietnam in battalion-sized groups.

(C) Based on these data concerning movement routes, an estimate of the number of sensors required for each CTZ can be made--given specific assumptions about the number of sensors required per route and their average lifetime. In this study, to provide the function of surveillance, we have assumed three emplaced sensors per route. The "string" of three sensors insures a high target-detection probability (greater than 0.9) with an operationally acceptable false-alarm rate (assuming appropriate spacing between sensors).* If one wishes, in addition, to provide for some measure of tracking or target reacquisition--given a delay between the initial acquisition and an appropriate reaction force (artillery, ground-attack aircraft, or ground forces)--then additional strings are required. (This case is considered in Sec. V.)

(S) Sensor "lifetime" depends on the type of sensor and the method of emplacement. Lifetime is affected most by the power drain on the batteries, which varies with the tactical use and the specific sensor. Typically, air-delivered seismic sensors have a maximum life of 180 days; hand-emplaced seismic sensors (in which lifetime has been sacrificed in favor of size and weight) have a maximum life of 60 days. Air-delivered acoustic sensors have a 30-day lifetime, and the hand-emplaced acoustic sensors (ancilliary to the hand-emplaced seismic) have a 60-day life. Table 9 illustrates DCPG/MACV experience based

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*(C) DCPG/MACV experience is to use three hand-emplaced sensors per string and four per air-emplaced string. Three sensors or one string on a route is considered the minimum number required to generate the intelligence to identify a target sequence in a go no-go manner. Air-emplacement requires larger strings because of inaccuracy of emplacement and higher infant mortality.

on a ground-sensor field of 1000. The table allows for a mixture of sensor types and emplacement techniques, a 10 percent increment for infant mortality and a 10 percent increment for inaccuracies of air emplacement. No allowance for sensor recovery and battery replacement has been included; for the hand-emplaced sensor in a static defense role, this could reduce sensor costs significantly, and will be reconsidered when the system is costed below.

(S) Table 9

IN-COUNTRY EXPERIENCE WITH EMPLACED SENSORS (U)

Type	Active in Ground	Increment for Infant Mortality	Increment for Implant Accuracy	Annual Required With Lifetime
Air delivered seismic	343	34.3	34.3	822
Hand-emplaced seismic	548	54.8	...	3617
Air-delivered acoustic	46	4.6	4.6	663
Hand-emplaced acoustic ancilliary	63	6.3	...	415
Total	1000	...	...	5517

(S) From Table 9, it can be deduced that sensor lifetimes for a mixed field average about two months. Combining this information with the identified route data of Table 8 (p. 41), and the assumption of three sensors per route for surveillance, yields the annual requirements for the border areas of South Vietnam. Table 10 displays these data by CTZ for each threat level

(C) Table 10 provides an approximation of the number of sensors required for complete coverage of all identified routes crossing the land border of South Vietnam. It shows roughly a 1.3-to-2.2 fold increase (depending on the threat) over the estimated number of sensors (1300) employed in border surveillance early in 1970. This increase would generate a need for additional data-relay, data-processing, and

target-assignment capabilities. Since these requirements are related to differing capabilities in each of the CTZs, they are discussed separately for each CTZ. The general philosophy behind each discussion of the relay, read-out, data handling, etc. capabilities for the Corps is, however, the same in one respect. It assumes that each Corps will have at least one set of read-out facilities at the CTZ Headquarters for overall coordination of operations, intelligence use and allocation of response resources when conditions require.

(C) Table 10

NUMBER OF SURVEILLANCE SENSORS PER CTZ (U)

Threats	CTZ	Number of Routes	Number of Sensors	Annual Number of Sensors
I and II	I	280	840	5,040
	II	173	519	3,114
	III	106	318	1,908
	IV	0	0	0
	Total	559	1,677	10,062
III	I	280	840	5,040
	II	173	519	3,114
	III	195	585	3,510
	IV	320	960	5,760
	Total	968	2,904	17,424

I CORPS TACTICAL ZONE

(S) As indicated in Sec. III, facilities exist in I CTZ for receiving sensor data from some of the Duffel Bag sensors (in-country, hand-emplaced sensors) and from air-emplaced sensors. The semi-automated Tactical Surveillance Center (TSC) of Duel Blade II receives, correlates, and disseminates this information to appropriate combat units including the Duel Blade II installations south of the eastern half of the DMZ.

(S) An expanded RVN surveillance program that employed 840 sensors on all identified routes along the I CTZ border would represent more than a three-fold increase over the early 1970 coverage. It would involve emplacing sensors in some remote, mountainous, and heavily forested areas. Air emplacement near trails and streams would require accurate knowledge of the location of the route, and accurate delivery. Use of F-4 aircraft for air delivery, as at present with U.S. forces, would have to be supplanted for the RVNAF by helicopter delivery or by hand emplacement using patrols or helicopter-lifted emplacement teams. For those infiltration routes where terrain permits, Vietnamese Air Force (VNAF) A-37 and A-1 squadrons could be trained and qualified for sensor delivery; since this is not presently programmed for the VIM, it would require an augmentation of that program.

(C) The early-1970 data-handling facilities are inadequate for the large number of sensors involved in an enhanced border surveillance system for I Corps. Such a program would require both data-relay facilities and data-handling facilities of increased capacity. Data relay from the sensors could be accomplished by a combination of airborne relay and mountain-top relay.

(S) Given the terrain in the area, three mountain peaks (Hills 950 and 1487, and Dong Ha Mountain) will suffice to provide relay of information from sensors covering portions of the western end of the DMZ and the A Shau Valley (see Fig. 8, p. 49). Coverage of the remaining areas could be achieved by EC-121R relay aircraft or YQU-22A Pave Eagle Automatic Data Relay aircraft. Note, however, that neither of these aircraft is presently programmed for the VNAF VIM. Furthermore, enemy activity in the vicinity of Hills 950 and 1487 have precluded their permanent occupation by U.S./RVN forces. Therefore, successful implementation of the relay program would require both:

a) Addition of the required aircraft to the VNAF VIM (alternatively this mission could be satisfied by USAF aircraft stationed in Thailand).

b) Manning and fortification of appropriate mountain top stations using Battle Area Surveillance System (BASS) relay equipment.

(S) Additional terminal facilities in I CTZ would also be required to handle the larger volume of sensor information. The Air Force-developed SRP (Sensor Reporting Post) has a capability to handle about 400 Phase III sensors; is compatible with both the EC-121R and the Pave Eagle; can monitor two independent sensor fields simultaneously; and incorporates automatic data-processing and display equipment. Also, the DART I (Deployable Automatic Relay Terminal) previously installed at Bien Hoa has been relocated to I CTZ. It has capacity for monitoring 150 Phase I sensors with relay from the EC-121R or the Pave Eagle. The Army-developed BASS I (Battlefield Area Surveillance System) being introduced in I CTZ also has a modest capability (200 sensors). The BASS III system, compatible with Phase III sensors, has about the same capability as the SRP (320-480 sensors); however, it is not configured for aircraft readout.

(S) Assuming the 840 border-control sensors for I CTZ will be incremental to those already in use, the combination of DART I, one SRP, and one BASS III should provide a capability for monitoring the sensor field for surveillance purposes. These facilities should probably be located at or near I CTZ DASC to insure rapid access to the command and control structure of the I CTZ-based VNAF.

(S) In summary, an expanded border surveillance for I CTZ would: 1) triple the use of sensors in the CTZ; 2) incorporate mountain top and airborne relays; 3) increase terminal and readout capabilities. A system of this type would represent a marked increase in the surveillance capability of I CTZ. As part of the VIM program, it would also require a marked increase in the scope of the operation presently programmed for the Vietnamese. Among the items that would be involved are:

1) An expanded training program for RVN forces in the use, maintenance, and management of large numbers of sensors and the operation and management of the DARTS, SRPs, or BASS III equipment.

2) Equipment for air delivery of sensors. As long as the 7th AF remains in South Vietnam, F-4 aircraft (with helicopter augmentation for delivery of either sensors or ground teams) could do the sensor emplacement. Under the estimated 1973 VIM program described in Sec. VI, VNAF will have no F-4s. It would have to rely on either A-37, A-1, or helicopter delivery; or be assisted by aircraft from Thailand. Training and qualification programs for the former option--presently not part of the 1973 VNAF VIM--would represent an important augmentation.

3) The Pave Eagle airborne relay aircraft (YQU-22) used in the manned mode would probably be a preferable aircraft for the South Vietnamese if they were to be provided with their own relay aircraft. However, this would require training of additional pilots and the installation of ground supporting equipment. All of these again would constitute a significant add-on to the 1973 VNAF VIM. An alternative would be mountain-top relay stations appropriately manned and fortified, or assistance from U.S. aircraft based in Thailand.

4) The command and control of the enhanced system would require close cooperation of ARVN and VNAF in the development of operating procedures and effective use of technology.

(C) The preceding description, based on the use of remotely emplaced sensors on all identified movement routes, represents a first approximation to an enhanced border surveillance program for I CTZ. Between the early-1970 border surveillance activities and the enhanced level described above, there are a number of intermediate possibilities. Generally they represent an extension of the present concept of border surveillance; i.e., concentration in those border areas that have been used as major infiltration routes, or are suspected of being likely infiltration routes. In I CTZ, there are a number of such

routes. Figure 8, a schematic of I CTZ, shows some of the main enemy base areas in the border area and some of the main infiltration routes. Of these routes, those crossing the DMZ and skirting the western end of the DMZ have received the greatest attention in terms of sensor emplacement and monitoring of traffic.

(S) Further south, the A Shau Valley and the routes in the southern portion of I CTZ have not received as much attention. One of the intermediate possibilities between early-1970 border surveillance activities and the enhanced border surveillance capability would provide increased coverage of these areas. Although some sensor emplacement has been done in the A Shau Valley area, it has not been an area of continuous monitoring.* It is likely that expansion of present border surveillance operations would concentrate on these remote areas, and could be a step in the direction of more nearly complete surveillance of the infiltration routes in I CTZ.

Reaction Capabilities

(C) As indicated above, this section considers only expanded border surveillance procedures that do not require major force deployments to the border area. As of early-1970, a large portion of the I CTZ border area--essentially the western end of the DMZ and almost all of the border extending south of the DMZ--had no ground forces or artillery fire bases permanently located to respond to infiltration.**

(C) Thus, the reaction to continued infiltration in these areas under an enhanced border surveillance pro[illegible] would depend primarily on air response or on the use of remotely based artillery. Both of these response modes have limited effectiveness against infiltration of the small units postulated as Threat Type I (Sec. III, p. 35). For

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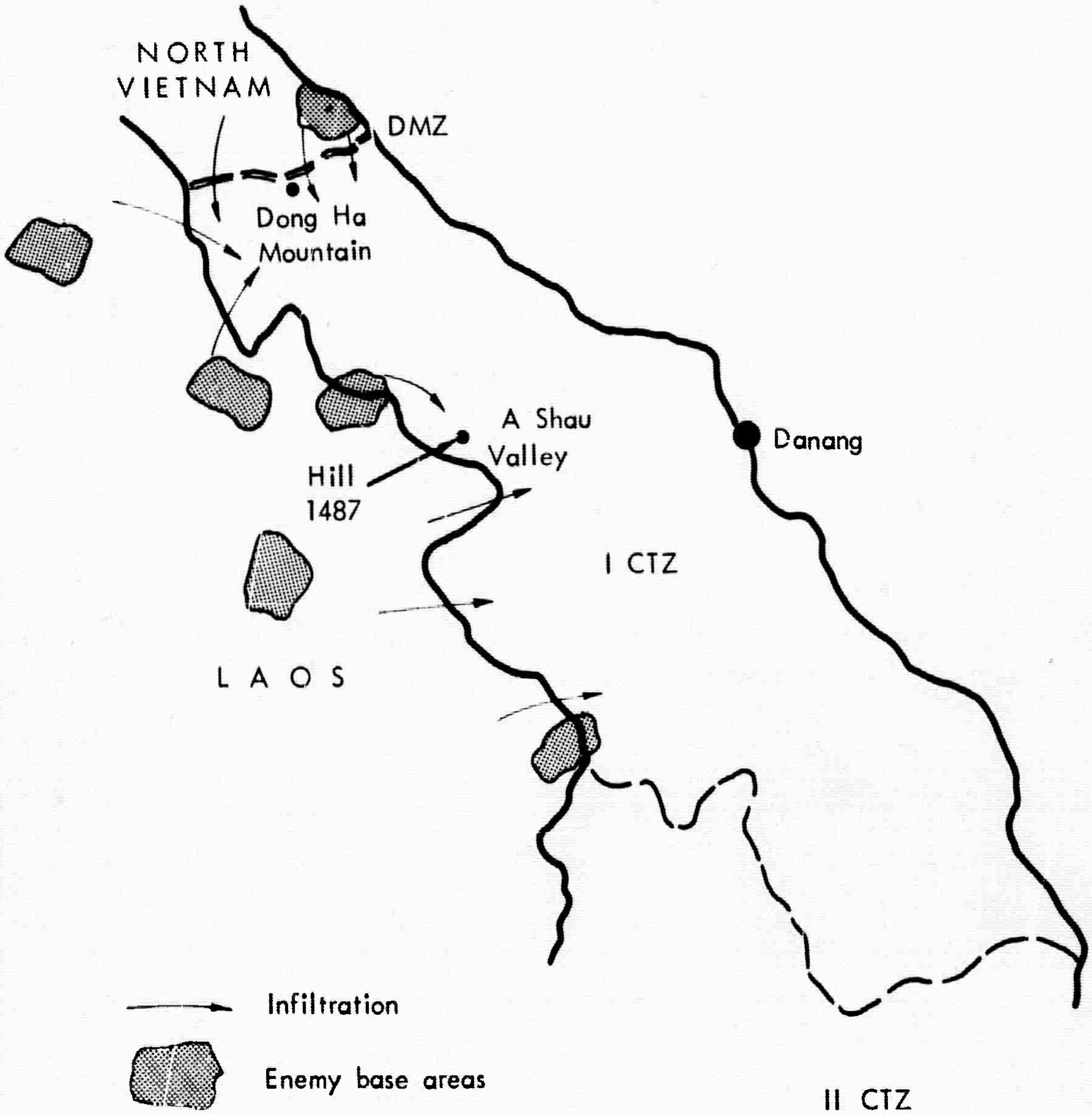
*(S) Proposals have been made, and perhaps already implemented, for increased surveillance of the A Shau Valley by emplacement of some 36 sensor strings.

**(S) Ground patrols and large-unit sweeps have been conducted into these areas, particularly the western end of the DMZ and the A Shau Valley; but with the withdrawal of forces from the Khe Sanh area, no forces are permanently located in the areas.



(S) Fig. 8 — Schematic of the main enemy base areas near the border and the main infiltration routes of I CTZ (U)

attack from the air, the limitation is based on response time and difficulties in locating small, mobile threats.* Although appropriate sensor and string spacing could ameliorate some of the difficulty, it is unlikely to eliminate the general problem. For artillery, the difficulties of delivering corrected (observed) fire through jungle canopy is a critical factor. Against larger units the effectiveness of both air and artillery is somewhat higher since the larger units (Threat Type III) present targets which are more extended in space and time.

(C) Enhanced border surveillance in I CTZ would probably serve primarily as an intelligence gathering activity and secondarily as a means of targeting for air and artillery. It would certainly serve as a warning system for large-scale enemy movements and concentrations such as those around Khe Sanh in 1968, and of enemy build-ups such those that periodically occur in the A Shau Valley.

(C) As implied above, any useful response to enemy movements and concentrations would demand that the U.S. capability for massive delivery of air ordnance (B-52s, F-4s, etc.) be retained in support of the VNAF until some substitute is available to the Republic of South Vietnam. Assuming that the requirement for interdicting large enemy forces continues to exist as the U.S. withdrawal matures, the major alternatives open to the RVN for obtaining their own response capability would appear to be:

1) Temporary deployment of ground forces and artillery units to the border area to provide increased interdiction capability when the situation requires.
2) Providing an indigenous capability for massive air delivery of ordnance as part of the VIM. Among many possibilities are the use of the Banish Beach

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*(C) In Ref. 20, the probability of reacquiring a sensor-identified personnel target using aerial visual search techniques is estimated at about 0.1.

technique* and the development of more effective ordnance for use against large enemy units in jungle areas. The Caesar's Ghost munition,[21] is an example of the latter.** The fuel-air explosive (FAE) munition, currently being developed by the USAF, is another candidate.

(S) In summary, enhanced border surveillance in I CTZ based on sensor emplacement along all identified enemy movement routes would involve use of a substantial number of sensors, a (possible) combination of air and ground relays, and large-scale automatic data-transmission, processing, and dissemination facilities. The primary value would be for intelligence purposes and for targeting of large enemy units. As a rough estimate, for I CTZ and all of South Vietnam, about 10 percent of the infiltrating forces could be interdicted at the border with projected 1973 VIM strike capabilities. If the enhanced surveillance capabilities were to become part of the 1973 estimated VIM program, the Vietnamese would have to be provided with training, assets, and equipment not presently included.

II CORPS TACTICAL ZONE

(S) The border areas of II CTZ are largely mountainous, heavily forested, and sparsely populated by ethnic tribes. As indicated in Sec. III, counter-infiltration operations are conducted primarily by Special Forces/CIDG units based at camps in the border area, and by

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*(C) Banish Beach is the term applied to an area bombing technique developed in South Vietnam in 1968. The technique involves air delivery of 55-gal drums of JP-4 and diesel oil, which burst upon impact and burn over large areas. Although C-130s were used in the 1968 trials, C-47, C-119, and C-123 aircraft included in the 1973 VNAF VIM would be appropriate. A detailed report of the Banish Beach tests can be obtained from the Air Force Armament Laboratory, Eglin AFB, Florida.

**(C) Caesar's Ghost is an unguided air-ground rocket concept with a high single-pass kill probability against trucks and a high lethal area against personnel. Projecting a cluster of flechettes to very high velocities (6500-7000 fps), it is unusually effective through heavy jungle foliage. Since it is an area weapon, the location of the target centroid need only be known with a CEP of about 100 ft.

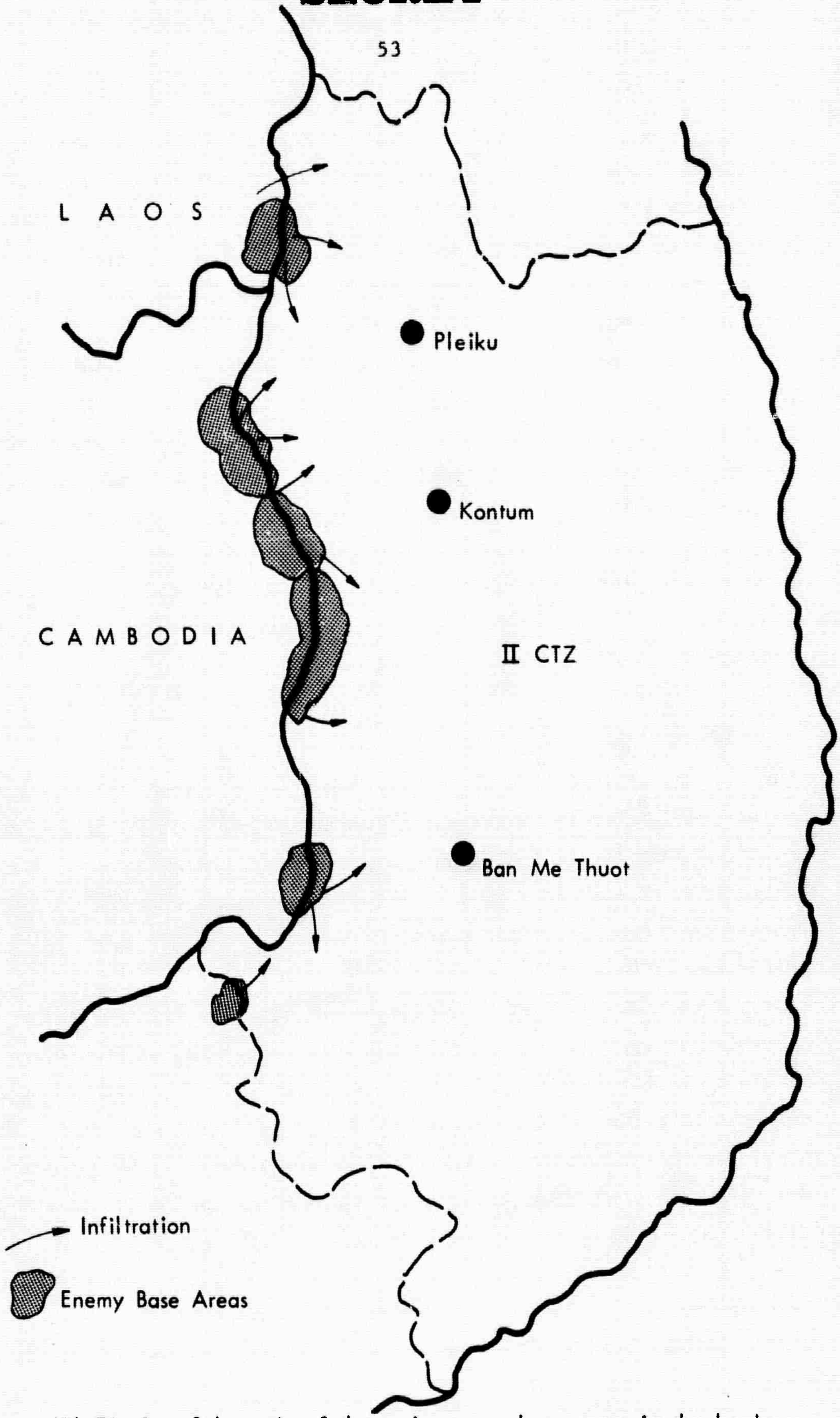
elements of U.S. forces (4th Division) and ARVN forces (23rd Division). Additional border surveillance is provided by air-emplaced sensors in the tri-border area, with data relayed via EC-121R aircraft to the DART II at Pleiku.

(S) An enhanced border surveillance program based on sensor emplacement along all identified movement routes in II CTZ would use about 500 sensors, or 2 1/2 times the number estimated in use in early 1970. As in I CTZ, this would require increased emplacement, relay, data-processing, and data-dissemination capabilities.

(S) Sensor emplacement in II CTZ involves largely the same considerations as those discussed for I CTZ, i.e., aircraft or helicopter delivery. The mountainous and heavily forested terrain requires the same precise location of the routes, accurate sensor emplacement, positioning for transmission to relays, spacing, etc. As in I CTZ, a combination of appropriate delivery and emplacement techniques would have to be developed in terms of each specific situation.

(S) Data relay, already accomplished by the EC-121R, could be supplemented or supplanted by use of the Pave Eagle or mountain-top relays. Automated data processing, based on the same estimates as those made for I CTZ, would require the equivalent of one SRP or one BASS III system. Either system could augment DART II at Pleiku, the location of both II Corps and ARVN 22nd Division headquarters. Alternatively, the system could be emplaced in the southern portion of II CTZ, perhaps at Ban Me Thuot, headquarters of the ARVN 23rd Division. Read-outs would be made at these locations, which could serve as Tactical Surveillance Centers, or the data could be relayed to the tactical operations centers of appropriate ground units, artillery fire bases, and Special Forces camps. Figure 9 displays the recommended sites.

(C) Again, intermediate programs between early-1970 operations and the enhanced surveillance program described here would be possible. Coverage in the tri-border area and the regions opposite Kontum and Ban Me Thuot (locations of main enemy base areas and infiltration routes; see Fig. 9) would be a less-than-complete but positive step in the direction of enhanced surveillance.



(S) Fig.9 — Schematic of the main enemy base areas in the border area and the main infiltration routes of II CTZ (U)

(S) Also, as in I CTZ, a large portion of the border area is not permanently covered by artillery fire or by ground units. Of the approximately 400 km of II CTZ border, an estimated 100 km is covered by fire from permanently located artillery sites, including those of the Special Forces camps. Continued dependence on air strikes to counter infiltration into II CTZ would be necessary.

(S) In summary, most of the previous statements regarding I CTZ are appropriate to II CTZ, including those in reference to the VIM program if the facilities and operations are to be eventually turned over to the Vietnamese. Large-scale training programs in sensor use, management, and maintenance would be needed; appropriate delivery systems, relay facilities (including aircraft), and reaction systems would be necessary; and large-scale data-processing, communication, and dissemination facilities would have to be operated and maintained by the Vietnamese.

III CORPS TACTICAL ZONE

(S) As indicated in Sec. III, border surveillance and security operations in III CTZ, since they guard the approaches to Saigon, are more highly developed than in any other part of South Vietnam. Sensor utilization is also at a peak in III CTZ. Of the approximately 1000 sensors used throughout the Corps, an estimated 500 are used in the border area. Some of these are used by combat units in the border area. Others are used in surveillance and security roles with the information relayed to various read-out locations. Nui Ba Den (Black Virgin Mountain), north of Tay Ninh City, serves as the BASS relay to read-out locations at Cu Chi and with brigades of the U.S. 25th Division. United States Navy activities include GIANT SLINGSHOT, part of the SEA LORDS operations employing sensors along the Vam Co Dong River on the eastern side of the Parrot's Beak.

(S) Border surveillance in III CTZ, based on the data presented in Table 10 (p. 44), would involve 300-600 sensors (depending on the threat level)--of the same order as the estimated early-1970 levels of

sensor employment.* Relay capability at Nui Ba Den would probably be adequate to handle the array of sensors. A possible exception would be those used along the northern portion of the Corps border; it contains rolling topography that could shadow the sensor transmissions. In this area, aircraft or additional hill-top relays to the read-out locations would be required.

(S) The early-1970 data-handling capability of the BASS I installation would be inadequate and would have to be augmented by additional facilities--such as those of BASS III and the SEA LORDS Vans (SLV)--to operate with local tactical unit operations centers. Since ground units, Special Forces camp personnel, and naval units operate in the Cambodia-South Vietnam border area, and artillery fans cover a substantial portion of the border, greater read-out capability at low echelons would be desirable.

(C) Prior to the spring 1970 incursions into Cambodia, a large number of enemy base areas existed along the border of III CTZ. The closeness of the border to such population centers as Saigon and Tay Ninh City, and the relatively large population living in the border area itself, all contributed to reliance on a defense system located as close to the border as possible. Border surveillance based on remote, hand-emplaced sensors was only one element of this defense. Locally emplaced sensors (around fire support bases, patrol bases, and other installations in the border area), radar, night observation devices, and other equipment to enhance the capabilities of local ground and naval units also contributed. For the assumed threat levels I and II of this study, the early-1970 sensor utilization would suffice; for threat level III, some small augmentation (approx. 20 percent) seems warranted.

(S) In summary, III CTZ, particularly that portion of the CTZ including the approaches to Saigon, is heavily defended. Border

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*(C) The use of ground surveillance radars, with foliage-penetration capability and moving-target indication (MTI), could serve to augment some of the sensor coverage. Their use, discussed below under the enhanced surveillance of IV CTZ, would be equally appropriate to some portions of III CTZ.

surveillance constitutes the forward element of the defense. A variety of U.S. and RVN ground and naval units operate in the border area at least occasionally. Extensive utilization of sensors, most of which were hand emplaced, contributed to effective employment of artillery, ground, and riverine patrols in the early-1970 period. Unlike I CTZ and II CTZ, the flat and relatively open terrain throughout most of the Corps, and the accessibility of much of the border area, does not necessitate stress on air emplacement of sensors, aircraft relay or air response. Thus, although the implications for the VIM program are similar in regard to capabilities required for large-scale sensor employment, data handling, operations, maintenance, and management, they probably do not involve air emplacement of sensors and extensive relay facilities. Moreover, the use of air or artillery to counter infiltration under jungle cover would be limited to the northern part of the Corps.

IV CORPS TACTICAL ZONE

(C) The terrain of IV CTZ is largely flat, with much of it subject to inundation during the peak run-off of the rainy season. It is a network of streams and canals during the dry season. The population density is higher along the border than in any other area of South Vietnam; and there is a large amount of cross-border traffic, particularly during daylight hours, including illegal movement of goods between Cambodia and South Vietnam.

(S) The major border surveillance and border security operations, as indicated in Sec. III, include the U.S. Navy SEA LORDS operations of GIANT SLINGSHOT (along the Vam Co Tay River on the western side of the Parrot's Beak), Barrier Reef, and the Tran Hung Dao operation of the South Vietnamese Navy. Sensors are used extensively in these operations, with up to three SEA LORDS Vans (SLV) located in the vicinity of Ba Xoai, Thong Thoi, and Tuyen Nhon. Also, local emplacement and read-out originate from specific operations along the canals and streams. In addition to naval operations involving riverine patrols, Seal, and Sea Wolf forces, there were (as of early 1970) Special Forces camps, Regional and Popular Forces (RF/PF) units, and three ARVN Divisions (the 7th, 9th, and 21st) in IV CTZ.

(S) Assuming conditions in Cambodia revert to the early-1970 level of enemy activity, border surveillance in IV CTZ based on sensor use along identified routes would require about 1000 sensors, roughly three times the number then in use. Relay of the increased volume of sensor information could be provided by installing tower relay equipment in addition to facilities involved in ongoing operations. A combination of such equipment plus relay stations on Nui Ba Den, peaks in the Seven Mountains area, and on Hon Tre Island, would be sufficient. Data processing at the SEA LORDS Vans could be augmented by one or two additional facilities, such as a BASS III. Readout to local tactical unit operations centers and ground force installations, including Special Forces camp locations, would be feasible.

(S) Because of the flat terrain, sensor coverage of the border area could be augmented (or replaced in some locales) by the use of radars. Foliage penetrating, moving-target indicator (MTI), ground surveillance radars of the TPQ-33 and TPQ-34 type are likely candidates. From two to nine radars would provide coverage of high infiltration areas, or almost the entire IV CTZ border area.

(S) Reaction by ground, naval, or artillery forces to sensor and radar information could follow early-1970 patterns. Of the approximately 320 km of border in IV CTZ, over 75 percent was covered by existing Special Forces and ARVN artillery. Riverine operations provided additional coverage.

(S) In summary, the flat and open terrain of IV CTZ makes it possible to use a more densely emplaced combination of sensors and foliage-penetration, MTI radars to enhance border surveillance. Ground and riverine sensor emplacement is feasible, and relay of sensor information can be accomplished by ground based relays. One or two additional facilities for data handling would be necessary for threat level III. For threat levels I and II, early-1970 sensor coverage and RVNAF reaction to border infiltration would suffice. Artillery coverage of the border, and the availability of ground and naval units (U.S. and Vietnamese) to respond to detected infiltration is fairly extensive. Turnover of operations to the Vietnamese under the VIM

program would involve the same training, operation, and maintenance considerations as those for the other CTZs, plus the addition of those related to the radars.

ESTIMATED COST OF E.·ANCED BORDER SURVEILLANCE

(S) The enhanced border surveillance described above for each of the four CTZs would require expenditures for emplaced sensors, radars, mountain-top relays, data-handling and readout facilities (e.g., the SRP or BASS III with their associated communications), support, and maintenance. In addition, several areas would require sensor emplacement by air, and air-relay facilities. A detailed cost estimate for such capabilities would require specific descriptions of the equipment incorporated into each CTZ. To obviate such a detailed design analysis and to permit a preliminary cost estimate, we make the following assumptions:

1) The number of sensors used (1700-3000) would be of different types (seismic, acoustic, etc.) with an average unit cost of $1275.* Table 9 (p. 43) assumes strings of three sensors with a two-month replacement life. This includes an infant mortality level of 10 percent and, for the air-delivered sensors, an additional 10 percent increment for inaccuracy of delivery.

2) Sensor emplacement in the remote forested areas of I CTZ, II CTZ, and the northern part of III CTZ would be by a mixture of helicopters and A-1 and A-37 ircraft. Based on a requirement for delivery of about 1900 sensors for these three areas every

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*(C) This estimate, based on a private communication from DCPG, was developed by assuming a sensor mix equivalent to that in Table 9. Unit costs for air-delivered seismics range from $1560 to $1930 (avg. $1750); hand-emplaced seismics, from $300 to $1000 (avg. $700); air-emplaced acoustics, $3380; and hand-emplaced commandable microphones, $2185.

two months (see Table 10, p. 44), some combination of six aircraft and six helicopter sorties would be needed daily.* In estimating the costs, only helicopters are assumed since their capabilities for precision delivery are more appropriate for sensor emplacement along trails than are those for the A-1 or A-37. However, helicopter delivery may not be possible in some areas because of enemy fire, and less precise delivery by tactical aircraft may be necessary.

3) For air relay of sensor outputs in I CTZ and II CTZ, it is assumed that four aircraft orbits would provide adequate coverage. As one alternative, this may be done by existing EC-121R aircraft; another alternative would utilize the Pave Eagle YQU-22A. As noted above, neither aircraft is currently included in the VNAF VIM. The cost estimates include 24 relay aircraft of the Pave Eagle type to provide the necessary continuous coverage, and some flexibility in the number of orbits. Pave Eagle has a flight time of 9-12 hours (depending on whether it is manned or flown as a drone), thus requiring a sortie rate of only 0.33-0.45 per possessed aircraft per day.

4) The number of foliage penetrating, MTI radars of the TPQ-33 or -34 type used in the costing for threat level III is the upper bound estimate of nine radars to provide border coverage for all of

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*(C) Assuming that on the average each aircraft (or helicopter with or without ground teams) would fly one sortie per day. From Table 9, the annual number of sensors for a field of 1900 would be 10,500, including infant mortality and delivery inaccuracy. For 12 aircraft, flying one sortie per day, this yields an average of 2.4 emplaced sensors per sortie. If the sortie rate turned out to be 0.5 per day, only 4.8 sensors per sortie need be emplaced--judged to be well within the limits of reasonableness.

IV CTZ. Threats I and II would utilize border-control radars in only selected locations with a nominal number of two used for the costing.

5) For ground relay of sensor and radar data, ten mountain-top relays are assumed for threat level III, and seven for threat levels I and II.

6) The basic SRP and BASS III systems are assumed to possess a data-handling capacity of 400 Phase III sensors. Costs include associated communication equipment and revetting of the installations.

7) The number of read-out stations is estimated at 30-53 (depending on the threat level), implying many small read-out facilities with ground or riverine units, at Special Forces camps, etc. The read-out facilities can vary from a fairly large Tactical Surveillance Center with some automatic data-handling equipment to a small tactical unit operations center, e.g., a few Portatales at a Special Forces camp. An average cost over this range of possibilities is taken as $15,000 each.*

8) Incremental training costs are difficult to estimate since the number of technicians involved can vary considerably. We have allocated $1,000,000 for this purpose in the first year to cover the salaries of American cadre. Vietnamese salaries are assumed to be included in the costs of the 1973 VIM, and subsequent-year training is assumed to be OJT.

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*(C) $15,000 will buy 1 Portatale and 1 event recorder (30 pen plotters) and some associated equipment. The combination of these two devices provides the capability of monitoring 57 sensors. Since 1700 sensors would be required for threats I-II, 30 readout sites would be required; 53 readout sites would provide capability for the 3000 sensors of threat level III.

(S) On the basis of these assumptions and estimates, the first-year (installation) and annual operating (recurring) costs of an enhanced border surveillance capability are presented in Table 11. The

(S) Table 11

ENHANCED BORDER SURVEILLANCE COSTS (U)

Threat		Number	Cost ($1000) Unit	First Year	Recurring
I & II	Sensors	10,062	1,275	12,830	12,830
	Radars	2	1,000	2,000	200[a]
	Helicopters	12	b	1,320	1,320
	Relay Aircraft[d]	24	954	27,390	4,500[c]
	Ground Relays	7	100	700	70[a]
	SRP	2	7,000	14,000	1,400[a]
	BASS III	1	1,500	1,500	150[a]
	Readout Facilities	30	15	450	45[a]
	Training			1,000	0[e]
TOTAL				61,190	20,515
III	Sensors	17,424	1,275	22,220	22,220
	Radars	9	1,000	9,000	900[a]
	Helicopters	12	b	1,320	1,320
	Relay Aircraft	24	954	27,390	4,500[c]
	Ground Relays	10	100	1,000	100[a]
	SRP	2	7,000	14,000	1,400[a]
	BASS III	4	1,500	6,000	600[a]
	Readout Facilities	53	15	800	80[a]
	Training			1,000	0[e]
TOTAL				82,730	31,120

[a]Based on 10 percent maintenance and spares annually.

[b]Assumed available from VNAF resources; only operating costs included.

[c]Includes VNAF personnel costs.

[d]Assumes Pave Eagle II, manned; costs based on detailed analysis of Igloo White operation.

[e]On-the-job training assumed after the first year.

estimated annual cost on a five-year basis* is approximately \$28-41 million--depending on the threat level.

(S) Cost estimates for an enhanced border surveillance program for the entire land border are based on covering approximately 500 to 1000 identified movement routes. Since these numbers are critical to the estimates, and since they are based on 1:50,000 scale maps, the estimates could be low. Figure 10 indicates the effect of monitoring larger numbers of routes on the estimated cost of enhanced border surveillance. The figure uses the costs in Table 11 as modified by the following scaling factors:

1) Required number of sensors is directly proportional to the number of routes monitored.
2) No additional radars are included.
3) No additional readout facilities are included.
4) No additional training cost is involved.
5) Both aircraft and ground relays are increased only 50 percent when the number of sensors is doubled.

(C) The cost data of Table 11 and Figure 10 are dependent not only on the number of routes monitored, but also on whether or not sensors are completely discarded after their nominal lifetimes or whether their batteries are replaced. As a rough estimate, enhanced surveillance system costs would be reduced by about 10 percent if batteries were replaced.

SUMMARY

(S) An enhanced border surveillance program, using current sensor and radar technology, could provide information on movement over all infiltration routes. Such a program could obtain intelligence on at least large-scale enemy movements and concentrations in remote areas, and be a basis for targeting enemy units in areas where it is possible to respond immediately with artillery fire or other

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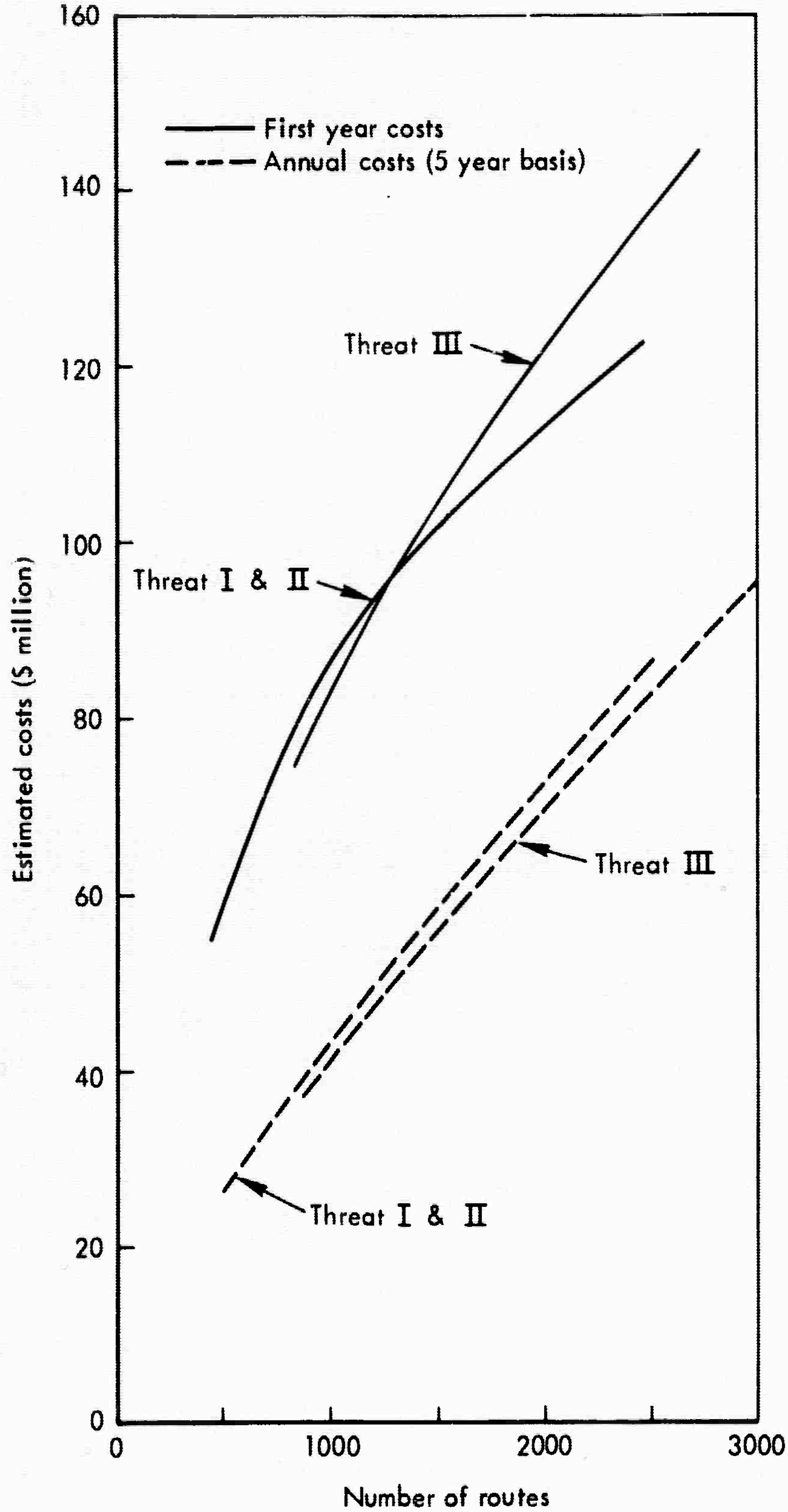
*(U) Annual cost on a five-year basis is defined as the first-year (installation) cost plus four years of operating (recurring) costs prorated over five years.



(S) Fig.10 — Enhanced surveillance cost versus number routes monitored (U)

means of reaction. Also, it could serve as the basis for air, ground, or riverine patrolling into suspected areas where immediate reaction is not possible. Overall improvement of about 10 percent in the interdiction of NVA infiltration across the borders of South Vietnam could be expected.

(C) Although part of the VIM program would eventually involve turnover to the Vietnamese of some training, operating, and reaction responsibilities cited above, some U.S. technical assistance might be required for continuing operation; e.g., up grading the systems to take advantage of U.S. research and development, especially as means of reacting to future enemy countermeasures.

(C) Finally, while an enhanced border surveillance capability of the type described in this section represents complete coverage of all infiltration routes, there are, as indicated, many alternatives involving less extensive coverage. Some of these alternatives (e.g., selective coverage of the A Shau Valley) might have a disproportionately high effect on the total system effectiveness relative to the fraction of the border or the number of trails covered and, therefore, might be highly cost-effective.

V. MANNED BORDER SECURITY SYSTEMS

INTRODUCTION

(C) The preceding section dealing with enhanced border surveillance assumes no substantial troop redeployments other than those directly associated with RVNAF taking over areas of responsibility from U.S. forces that are being withdrawn from South Vietnam. In a sense, that situation produces increased border surveillance capability without a commensurate increase in interdiction capability other than that provided by improved targeting opportunities for existing artillery and tactical air assets. We estimate that these additional opportunities will produce a 10 percent increase in the ability to interdict traffic.

(U) This section considers an improved border security program assuming that substantial troop redeployments to the border areas of South Vietnam can be undertaken. Two types of border security installations involving redeployment of forces are described, and estimates are made of their costs and effectiveness.

(U) The two systems discussed share certain features:

1) The purpose of each is to provide for both an increased capability for border surveillance and an increased capability for interdiction.
2) Although the arrangement differs in each, both systems involve two major components:
   a) "Screening forces" that are deployed forward to provide surveillance (or early warning) and some interdiction capability;
   b) "Fire support and maneuver forces," i.e., artillery and quick-reaction forces to engage the enemy once he has been detected. Although not part of the actual border installations, tactical air support is assumed to be part of the available fire support. Both the screening and reaction components

would be based at least partially in the immediate border area.*

3) Both systems augment present force capabilities with technological devices that are state-of-the-art; i.e., either currently available or available in the immediate future. No long-term, advanced development items are incorporated in the border security systems although several items adapted from existing equipment are included and described.

4) Both systems include an appropriate command organization controlling the battalions that garrison the strong-points. This organization is responsible in each TAOR to the area commander to whom it looks for support.

(C) Two types of border security installations (or systems) are considered:

1) "Strong-points";

2) "Strong-points" with a barrier.

The strong-point is a battalion-size defended position that employs patrols, artillery, and reaction forces (both locally and remotely based) to counter enemy infiltration through its area of responsibility. It depends upon the use of emplaced sensors and other devices as well as visual reconnaissance for surveillance of specific infiltration routes, and on fire and maneuver forces for interdicting infiltration in its area. The barrier system utilizes, in addition to the troops and equipment of the strong-point system, a continuous field

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*(U) A third component, although not part of the border security systems, consists of the regular military forces of South Vietnam. These forces have a variety of missions, including protection of key areas against enemy attack and engaging NVA or VC forces in their tactical areas of responsibility (TAOR). They also contribute to pacification operations and conduct offensive operations into areas held by the enemy. In the event of large-scale enemy operations in areas other than their TAORs, South Vietnamese forces can be committed to support the defense of these areas. In this sense, they are general reserves available for operations where their firepower and maneuverability are required to stop enemy attack.

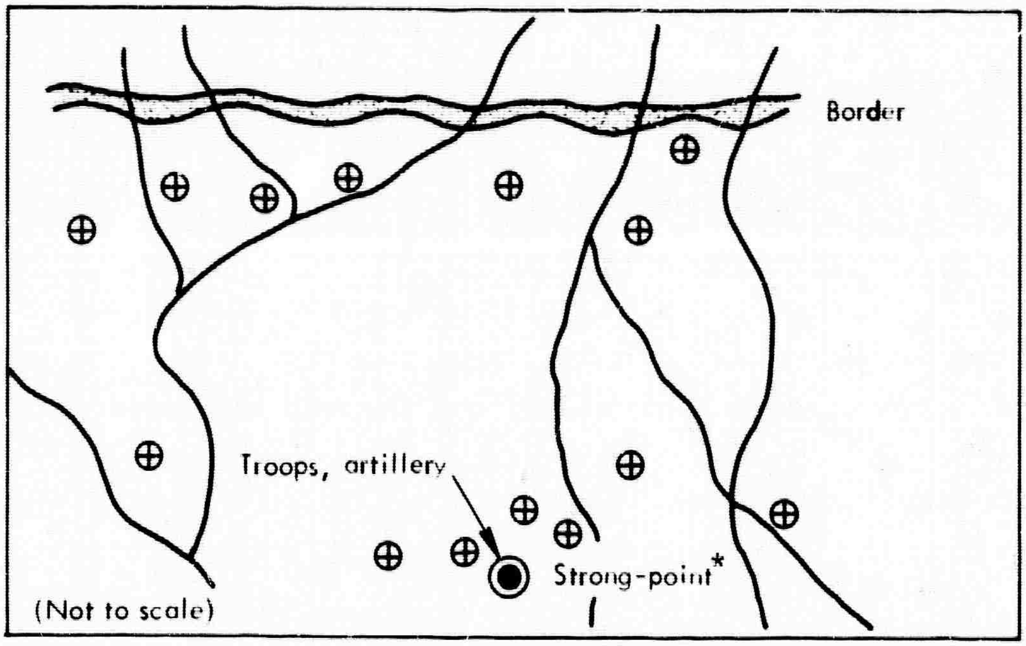
of sensors, obstacles, and emplaced ordnance along the front of its area of coverage. Figure 11 presents an idealized diagram (not to scale) of the two systems.

(C) Both systems perform essentially the same general functions:

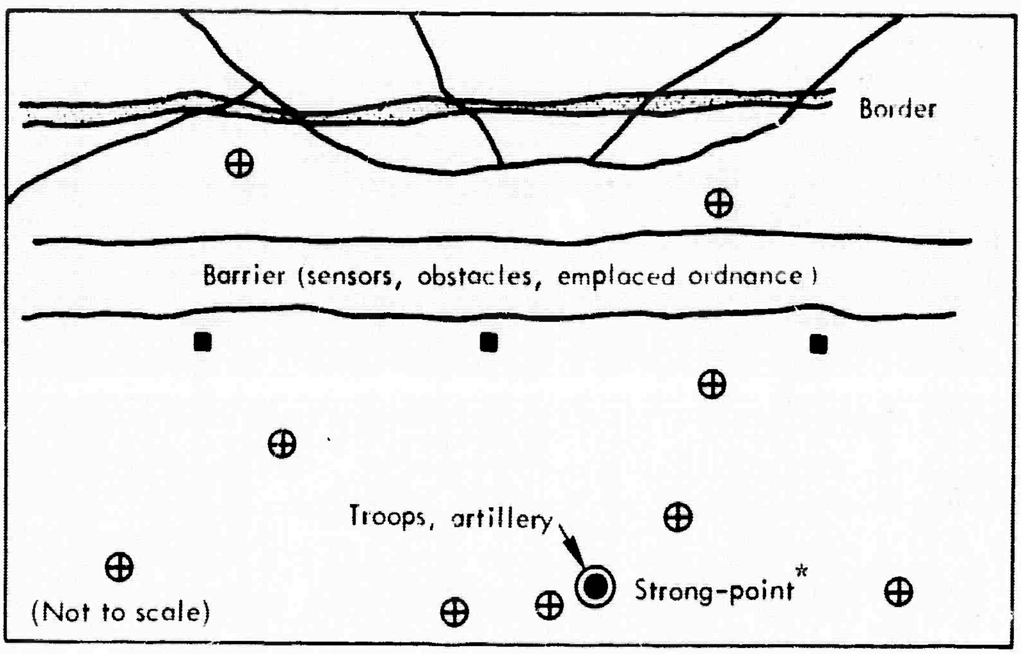
1) Surveillance:
   a) Direct monitoring of infiltration routes using both visual techniques and sensors;
   b) Remote monitoring of infiltration routes using sensors.
2) Interdiction:
   a) Ambush patrols;
   b) Artillery fire;
   c) Quick reaction forces;
   d) Air strikes.

(C) The two border security systems described in this report exemplify a class of systems. For example, the strong-point system could consist of lightly manned (company-size) small installations or of relatively heavily manned (battalion-size) installations. In our illustrative design, we have sized the installations at the battalion level. Similarly, the barrier system could consist of barriers of varying widths using different numbers and types of sensors, different widths of obstacles, and different amounts of emplaced ordnance.

1) A specific configuration presented for each system provides the basis for estimating cost and effectiveness. We recognize that many other manning levels, modes of operations, and types of equipment, etc. are possible depending on the local military conditions, type of infiltration threat, terrain, local operating conditions, etc. The particular configuration presented should therefore be regarded as an example of one of many possible installation types.
2) Although either the strong-point or the barrier type of system might be installed along the entire land border, it is much more likely that some form of one or the other system would be more appropriate to various



(A) Strong-point system



(B) Strong-point system with barrier

Infiltration routes
⊕ Patrols
■ Block houses
* Centrally-based but dedicated heliborne forces support strong-points

(C) Fig. 11 — Diagram of manned border security systems (U)

sections of the border. Therefore, as a matter of convenience, each system is described in terms of a single installation or module covering approximately 16 km of the border. This modular installation incorporates all of the main system functions. In the cost and effectiveness estimates presented in this report, the module is used as the basis for calculations. A comprehensive border security program would be based on a series of appropriate modules linked together along the entire border.

THE STRONG-POINT SYSTEM

Concept

(U) The concept of the strong-point system is to provide immediate, local reaction to infiltration in the border area. The system would consist of a string of semi-independent defense positions to survey the border area and to provide immediate local reaction with organic forces, including artillery and helicopters. The strong-point operations would be under the command and control of the Corps Tactical Zone (or other appropriate regional) headquarters, which would provide supporting forces from reserves if necessary.

System Configuration and Operation

(S) In our illustrative configuration, the defended bases or strong-points are spaced every 10-20 km along the border at a distance 5 to 10 km behind the border. The lateral spacing between strong-points, averaging about 16 km, is determined by the range of 155mm artillery. The distance behind the border, averaging about 8 km, is outside of the range of smaller enemy mortars fired from across the border. Present Special Forces/CIDG camps and existing artillery fire support bases (FSB) could provide locations for some of the strong-points.

(C) Taking into account irregularities of the border, a defense line of about 1400 km would be adequate. At a 16-km spacing, the entire length of the border (consistent with the assumption of threat level III) would be covered by 90 strong-point modules. For threat levels I and II, some 63 strong-points covering 1000 km would be adequate.

(S) Each installation would be manned by an RVN battalion, part of a 155mm artillery battalion (3 tubes), and part of an airmobile company (light) with 6 UH-1 type helicopters.* Each conceptual strong-point would have a read-out station or small tactical surveillance center (TSC) to monitor locally emplaced sensors and to display sensor information relayed from appropriate DART, BASS I, BASS III, or SRP facilities.

(C) Missions of the strong-point would include surveillance and interdiction of infiltrators in the border area. These missions would be carried out by specially equipped "surveillance-interdiction patrols" (SIP) operating along the border. These would be screening forces with responsibility for monitoring known or suspected infiltration routes, and for either interdicting (ambushing) small enemy units or calling for artillery interdiction fire, or for reaction forces against larger enemy units.

(U) Although the particular method of operation of the surveillance-interdiction patrols (SIP) would depend on the local military situation and terrain, one mode of operation might be as follows. The SIP would operate in teams of 6 to 12 men using a modification of the Sting Ray technique developed in South Vietnam by the U.S. Marine Corps. Each team would be airlifted as close to the border as conditions permit, and would operate for 3 to 6 days in a specified area in the vicinity of known or suspected infiltration routes.

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*(U) Helicopters would be replaced by tracked vehicles or water craft in some installations. System descriptions and costing consider only helicopters. For operational efficiency, the helicopters need not be based at the strong-point; they would, however, be dedicated to the support of that installation.

(C) In addition to items normally carried by long-term patrols (weapons, food, radios, etc.) each patrol would be equipped with:*

a) Hand-emplaced sensors;

b) Portable read-out devices (e.g., Portatales);

c) Starlight scopes;

d) Portable radars;

e) Claymores;

f) Remote firing devices for the claymores;

g) Fragmacord explosive.

(U) The SIP would establish ambushes of various types. Typically, it might place sensors, claymores, and fragmacord along a suspected route such as a trail. From an off-trail location it would monitor the sensors, releasing ordnance and engaging infiltrators on the trail. This is called the direct monitoring mode in this study.

(C) A variation would be to place sensors and claymores along several trails, monitor one of the trails directly and the others remotely; i.e., observe activity on all trails either directly or indirectly, and release ordnance on those trails where targets are encountered either directly or remotely. The latter is called the remote monitoring mode. Other variations are possible in which the SIP would place claymores along trails remotely monitored by the tactical surveillance center at the strong-point. These mines would be remotely fired by the SIP or the tactical surveillance center.

(C) In addition, the SIP could call for any artillery fire, reaction forces, or tactical air support needed to counter large infiltrating forces. Other missions of the strong-points would include:

1) Surveillance and interdiction (as required) of enemy troops in areas between and behind the strong-points. This mission would be carried out by specially equipped area security patrols, i.e., patrols equipped like the SIP. They would serve as secondary screening forces

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*(U) It is not implied that all this equipment would be hand-carried by the SIP throughout an operation. It would be helilifted in with the SIP (if appropriate), or carried in in stages, and selectively cached in appropriate locations for use when needed.

against enemy units able to infiltrate through the forward screen of surveillance-interdiction patrols. They would also cover the space between and behind the strong-points in those areas where local VC were operating. The modes of operation for the area security patrols would be similar to those of the surveillance-interdiction patrols along the border.

2) Reaction to enemy penetrations in support of the surveillance-interdiction patrols or the area security patrols. This mission would be carried out by artillery or the quick reaction elements of the maneuver forces at the strong-points. Additional quick reaction forces would be located with the helicopter support units at centralized bases. Collectively, these would be the fire and maneuver elements of the strong-point system. In addition, tactical air support strikes would be used when required and available.

(C) The allocation of the resources of the strong-point infantry battalion to these various operations would depend on the nature of the enemy threat, the number of infiltration routes, the terrain and other conditions. If, for purposes of estimation, we assume that the battalion had four companies assigned as shown in Table 12, it could

(U) Table 12

ALLOCATION OF STRONG-POINT COMPANIES

Strength[a]	Mission
120	Surveillance-Interdiction Patrol
120	Area Security Patrol
120[b]	Reaction Force
120	Strong-Point Defense

[a]Approximate manning level for strong-point companies.

[b]Half of this force is remotely based, for example at the locations shown in Table 13 (p. 74).

generate seven 6-man surveillance-interdiction teams (50 percent duty cycle for 4 days) together with their command and logistic elements, and an equivalent or greater number of area security patrols with shorter patrol periods.

(C) The battalion could also generate a company-sized reaction force, moved in two waves of 6 helicopters each, if all equipment were operational. If the half of this company at the remote base with the helicopters were held on ground alert and were required to arrive at the intercept point in no more than 30 min, the helicopters could be based up to 60 km from the SIP and area-patrol operating regions. Approximately 27 helicopter bases would be required for threat level III, and 21 for threat levels I and II (roughly 3 modules per base garaging 18-20 helicopters). Wherever possible these bases would coincide with existing province, district, or CIDG air strips. Table 13 is a first-cut estimate of their locations, including distances from the border (averaging 19.5 km). Defense of the bases would be accomplished by the reaction force and augmented by local RF/PF/CIDG.

(C) Although this level of operations would not "flood" the strong-point area of responsibility with forces, it would provide a considerable capability for monitoring infiltration routes and reacting immediately to small-unit infiltrations, and for bringing artillery fire and reaction forces, supported by tactical air, into action against larger units.

(C) The enemy might attack the defended strong-points either by rockets and mortars or by large-scale assault. Based on past experience with Special Forces camps, fire-support bases, and other installations, enemy assaults on well-defended battalion positions have almost always failed.* As indicated above, this study makes no attempt to evaluate the effectiveness of base defenses against direct enemy

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*(C) One example of the effectiveness of a well-defended position involving preplanning of defenses, use of sensors, and coordinated use of fire support is the defense of Fire Support Base Crook of the U.S. 25th Infantry Division in June 1969 (described in Ref. 22). Attacked by elements of the 88th NVA Regiment, the three phase defense/offense concept resulted in over 400 enemy KIA and one U.S. KIA.

(C) Table 13

ILLUSTRATIVE SET OF HELICOPTER BASES BY LOCATION AND DISTANCE FROM BORDER (U)

Province	Location	Distance to Border (km)
Quang Tri	Cam Lo	14
Quang Tri	Huong Hoa	9
Quang Tri	Trieu Phong	19
Thua Thien	Phong Dien	41
Thua Thien	Huong Thuy	45
Quang Nam	Thuong Duc	47
Quang Nam	Route 14, near Quang Tin Border[a]	31
Quang Tin	Route 14, Latitude 15°25'	14
Kontum	Dak Sut	11
Kontum	Dak To	27
Kontum	Mang La	39
Pleiku	Route 19	10
Pleiku	Ya Lop River	12
Darlac	Pleiku Border[a]	24
Darlac	Ea Krong River	27
Quang Duc	Duc Lap	8
Quang Duc	Route 309	8
Phuoc Long	Song Be	26
Binh Long	An Loc	21
Tay Ninh	Route LTL 13	32
Tay Ninh	Hieu Thien	12
Kien Tuong	Moc Hoa[b]	7
Kien Tuong	Tuyen Binh[b]	8
Kien Phong	Hong Ngu[b]	8
Chau Doc	Chau Doc[b]	7
Chau Doc	Tri Ton[b]	12
Kien Giang	Ha Tien[b]	7
		Avg. 19.5

[a]New installation.

[b]Not required for threat levels I and II.

attack. It is assumed that stressing the importance of well planned defenses and coordinated use of resources available at the strong-point (or at adjacent strong-points capable of moving forces to support the strong-point under attack) would be a priority item for the RVN battalion commander.

(S) Against possible major assaults by several divisions, it is further assumed that the concentration of enemy forces across the border would be detected and appropriate elements of the corps general reserves would be available to support the strong-point(s). This type of situation--illustrated by the defense of Khe Sanh in early-1968--is one in which determined defense, efficient use of intelligence, and massive artillery and air support can prevent the enemy from over-running a strong-point.

ESTIMATED COST OF A STRONG-POINT

(C) The cost of a strong-point module can vary considerably depending on whether it is constructed as part of an existing Special Forces camp or artillery fire support base, the level of manning, the terrain in which it is constructed, and other factors. For purposes of cost estimating, the following assumptions are made for a "standard" strong-point module:

1) It is manned by one battalion of 714 men. However, since we are not postulating an increase in the overall 1973 projected force structure, no incremental capital or normal operating costs are assessed for the battalion. However, it would require special training for border control duty and a cost increment is included for that purpose.
2) It has three 155mm artillery tubes (equivalent to one-sixth of a 155mm artillery battalion). Inasmuch as the ARVN artillery forces are scheduled to grow 15 percent over 1970 levels (amounting to a 55 percent reduction from combined US/RVN levels), half are assumed available from the VIM for threat levels I and II; threat level III, however, is estimated to require the full incremental force.
3) It has six UH-1 helicopters (equivalent to one-third of a U.S. Airmobile Company, Light), dedicated to its support. Half are assumed available from the VNAF VIM, and half would require an augmentation to that program.

4) No prior construction or facilities exist at the site. If existing CIDG and FSB installations are available for use, this assumption is obviously conservative.

5) Cost estimates are based on U.S. construction costs (probably higher than those of RVN construction).

(C) Training costs for the strong-point battalion are assumed one-time costs; subsequent training will be OJT. The training cycle is assumed 3 months, and the cadre to trainee ratio is taken as 1:10. Only the cadres (assumed U.S.) are costed.

(U) Special equipment costs are presented in Table 14.

(C) Construction costs are based on data in Ref. 4. These include clearing of the area (where necessary) and construction of troop facilities, watch towers, artillery revettments, a heliport, vehicle park, and power generators. The facility is surrounded by a barbed-wire perimeter, communication trenches, and firing bunkers. Included separately in the construction costs are six helicopter shelters* and the cost of constructing (or improving) 20 km of road access to and between strong-points.

(C) The manning levels and estimated costs for the military units, the construction, and the special equipment for a strong-point are summarized in Table 15, which indicates first-year installation costs and recurring (annual) operational costs. In the recurring costs, maintenance for the construction is assumed to be within the capabilities of the military units, and special equipment costs are based on varying amounts of replacement.

(C) Based on the various assumptions and estimates made, the annual cost of a strong-point module over a five-year period is shown in Table 16, which also indicates the manning level. Table 17 displays the total manpower (border troops and rear support troops) and total cost for a system of strong-point modules along the entire land border of South Vietnam.

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*(U) These shelters, probably not necessary at all strong-points, would be for operational use, not basing.

(C) Table 14

ESTIMATED COSTS AND AMOUNTS OF SPECIAL EQUIPMENT FOR ONE STRONG-POINT (U)

Type	Est. Unit Cost ($ Thousands)	Basis	Number (Annual)	Cost Per Strong-Point ($ Thousands)
Foliage Penetration Radar (TPQ-33/34 equivalent)	1000.0	1 per strong-point in regions 9-10; 1 per 5 strong-points elsewhere.	1	200 - 1000
Man Portable Radar	15.0	1 per patrol	14[a]	210
Sensors (hand emplaced)[b]				
Patrol Use	1.44	11 trails per module; average lifetime 45 days; 3 sensors per trial.[c]	268	386
Strong-Point Defense	1.44	30 in approaches to perimeter	243	350
Read-out Equipment for Patrols, Strong-Point	15.0	15[a,d]	15	225
Starlight Scopes	2.0	2 per patrol[a]	28	56.0
Night Observation Devices	20.0		4	80.0
Location Beacon	10.0		1	10.0
TOTAL				1520 - 2320

[a]For 7 surveillance-interdiction patrols and 7 area security patrols.

[b]Assumes 50 percent Minisids ($1000 ea), 25 percent Emids ($2963) and 25 percent Magids ($800).

[c]Assumed to be used in conjunction with enhanced surveillance system, i.e., a total of six sensors per trail.

[d]Portatales assumed for the patrols and a 30-pen event plotter assumed for the strong-point. This read-out equipment additional to that required for the enhanced surveillance system.

(C) Table 15

ESTIMATED COST OF ONE STRONG-POINT MODULE (U)

Item	Manning Level	Annual Cost ($ Millions) First Year	Recurring
1. Strong-point units			
RVN Bn (training)[a]	714	0.2	0
Artillery (1/6 Bn)	97	0.1-0.2[b]	0.1
Airlift (6 UH-1)[c]	58	1.5	0.8
Artillery Ammunition[d]		0.9	0.9
2. Construction			
Strong-Point		.7	---[e]
Helicopter Shelters (6)		.3	---[e]
Roads ($12K per km)		.2	---[e]
3. Special Equipment		1.5-2.3	1.0[f]
TOTAL[g]	869	5.4-6.3	2.8

[a] Based on costs of 71 U.S. cadre for 3 months.

[b] One-sixth of a U.S. 155mm Artillery Battalion, Towed, less trucks and personnel costs.

[c] Three-twentyfifths of a U.S. Aviation Company (Airmobile), Light Helicopter, less personnel costs.

[d] Depends on level of threat. Assumed 10 rds/day of a mixture of HE and ICM at an average of $250 each.

[e] Maintenance and materiel assumed to be within capabilities of strong-point units.

[f] Includes annual cost replacement of sensors, and 50 percent per year replacement of other equipment, excluding foliage penetration radar in Table 14 (p. 77).

[g] Module for threat levels I and II would cost $5.4 million the first year; module for threat level III would cost $6.3 million.

(C) Table 16

MANNING LEVEL AND TOTAL ANNUAL SYSTEM COST FOR 16-KILOMETER STRONG-POINT MODULE (U)

Manning[a]	Cost ($ Millions)	Location/Threat
1677	3.32	Regions 1-8, Threat Level I & II
	3.34	Regions 1-8, Threat Level III
	3.50	Regions 9-10, Threat Level III

[a]Includes 869 strong-point personnel and 808 rear support personnel.
[b]Annual cost based on 5-year system cost.

(C) Table 17

ESTIMATED MANPOWER AND ANNUAL COST OF COUNTRY-WIDE STRONG-POINT SYSTEM (U)

Threat Level	Manpower	Cost ($ Millions)[a]
I & II	106,000	216
III	151,000	312

[a]Two additional modules have been included to allow for the cost of the two additional helicopter bases required in Table 13 (p. 74).

(C) In summary, one possible border security system with the capability for local reaction to infiltration across the land border of South Vietnam could consist of 63-90 battalion strong-points (depending on the threat) of the type described in this report. It would include a forward screen of forces (specialized surveillance-interdiction patrols), area patrols, plus fire support and maneuver forces (artillery and air-lifted reaction forces) in depth. These would be augmented by the reserves in each Corps Tactical Zone and by tactical air support when required. The total strong-point system would require 106,000 to 151,000 personnel, depending on the threat, including those

in rear support; and would cost from $200-300 million annually. Costs of this system are not nearly as sensitive to the assumed number of trails (as are those of the enhanced surveillance system) because of the many fixed and dominating costs associated with the strong-point facility.

THE BARRIER SYSTEM (STRONG-POINT PLUS BARRIER)

Concept

(U) The concept of the barrier is to increase the capability of the strong-point for immediate and local reaction to infiltration. Many different types of barriers could provide these capabilities. They could take the form of heavily fortified and heavily manned installations such as the Maginot Line, or they could be more austere installations such as the electrified fence used in Algeria. The type considered in this report involves a unique concept that employs detection devices linked to emplaced ordnance through a communication network under human control. For this reason, it is considered a semi-automated barrier (SAB).

System Configuration and Operation

(S) The "barrier system" module consists of the SAB and its associated strong-point. A string of such modules might be installed along a border control line or "trace" located at various distances inside the border. One such control line (described in Ref. 4) is based on several considerations, including:

1) Use of existing terrain features for defense;
2) Avoiding areas in dispute with Cambodia;
3) Providing a stand-off distance from the border for intelligence operations and forward patrolling.

Figure 12 shows the illustrative border control line (insert).

(C) The border control line is about 1400-km long. Approximately every five kilometers along the barrier line, a blockhouse for controlling that section of barrier is located. Every three blockhouses

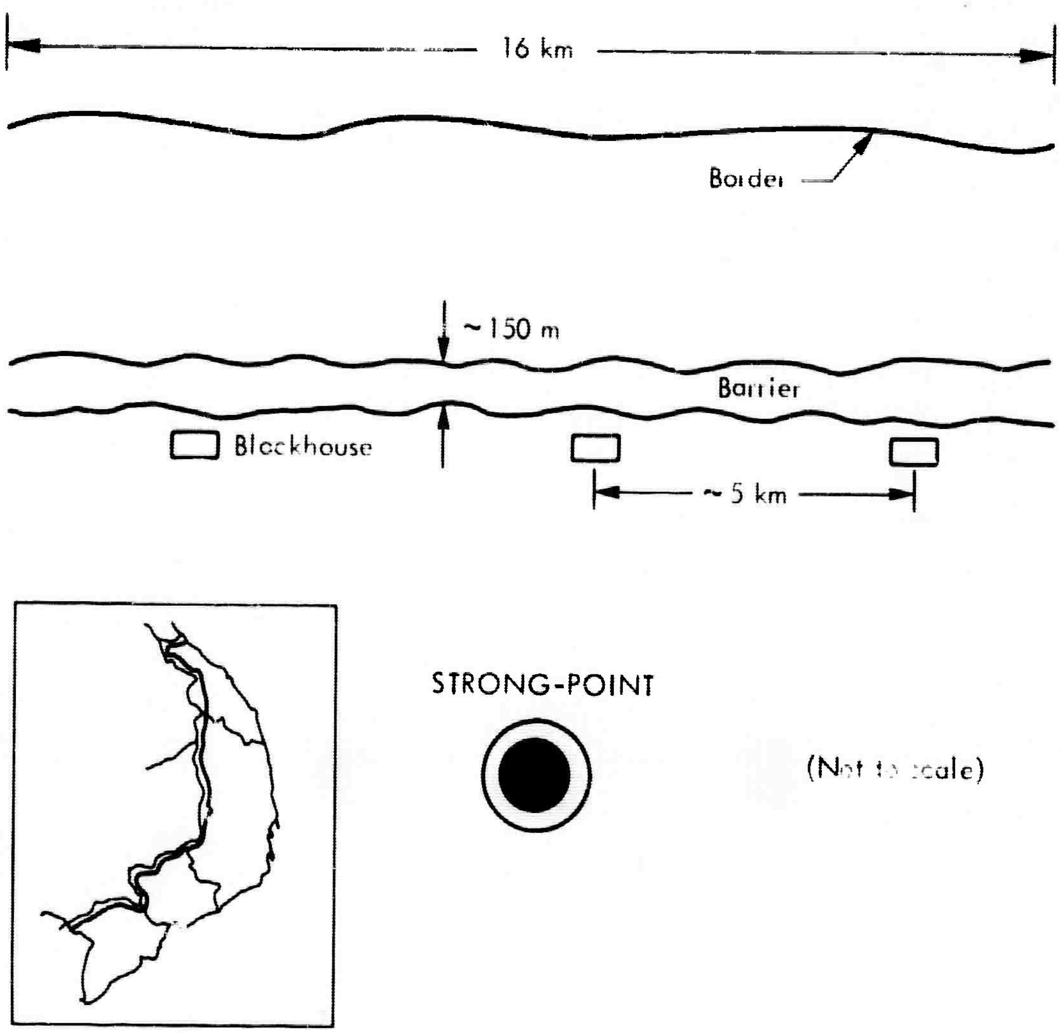

Fig. 12 — Schematic of 16-km barrier system module

(16 km), a strong-point is located at varying distances behind the barrier line. Additionally, a string of helicopter bases support the strong-points from locations such as those suggested in Table 13 (p. 74). Figure 12 shows a schematic of the 16-km barrier system module.

(S) Each strong-point installation of the barrier system would be similar to the strong-point described above. It would be manned by an RVN battalion, augmented by three tubes of 155mm artillery, and supported by six remotely based UH-1 type helicopters. Each strong-point would have a read-out station for locally emplaced sensors and for read-out from appropriate DART or BASS I facilities (or BASS III-SRP facilities).

(C) The functions of the barrier system would be similar to those described for the strong-points it embraced, although the manner in which they are carried out would differ:

1) Surveillance and interdiction in the immediate vicinity of the border. However, only a few surveillance-interdiction patrols (SIP) would operate forward of the barrier as screening forces. The others would operate the blockhouses of the barrier, which is itself a forward screen for surveillance and interdiction operations. Unlike the SIP, however, the barrier would provide continuous surveillance and interdiction coverage along the border control line. The major contribution of the barrier to border security is the substitution of continuous coverage and immediate interdiction capability for selected coverage of infiltration routes by SIP.

2) Surveillance and interdiction (as required) of enemy troops between and behind the strong-points. This function would be performed by the strong-point area patrols as described above (pp. 71-72).

3) Reaction to enemy penetrations in support of SIP or area patrols would be the same as described above,

i.e. by the fire (artillery) and maneuver (quick reaction) forces of the strong-point or by tactical air support of the reserve forces. In addition, the strong-point artillery would be pre-registered on the barrier area so that improved conventional munition (ICM) fire could be brought to bear rapidly against infiltrators detected in the barrier.

(C) The barrier portion of the system would consist of a cleared strip, detection devices of several different types, obstacles and emplaced ordnance, and blockhouses. Figure 13 presents a schematic of one possible barrier lay-out.

(C) A string of manned blockhouses located 5 to 6 km apart along the entire cleared strip would be most important to the operation of the barrier. They would be protected and supported from the strong-points situated 5 to 7 km behind the barrier.

(C) A communications system would enable blockhouse personnel to monitor the sensing equipment emplaced in the barrier and to exercise immediate control over either emplaced or delivered ordnance. These personnel would also perform routine maintenance of equipment under their control. Through proper training and careful delineation of command responsibilities, the actual decision-making and operational process could probably be made relatively routine and eventually highly effective.

(C) Emphasis has been placed on developing a cohesive and flexible system focused on mission requirements and responsive to varying external conditions. As far as possible, several kinds of countermeasures that a resourceful enemy might be expected to devise have been anticipated. Some examples are discussed later in this section (see pp. 85-89).

(U) <u>The Cleared Strip</u>. Surveillance and interdiction would be greatly improved by a strip of land from which all vegetation and natural obstructions are removed. A suitable width would be around 150 to 300 meters.

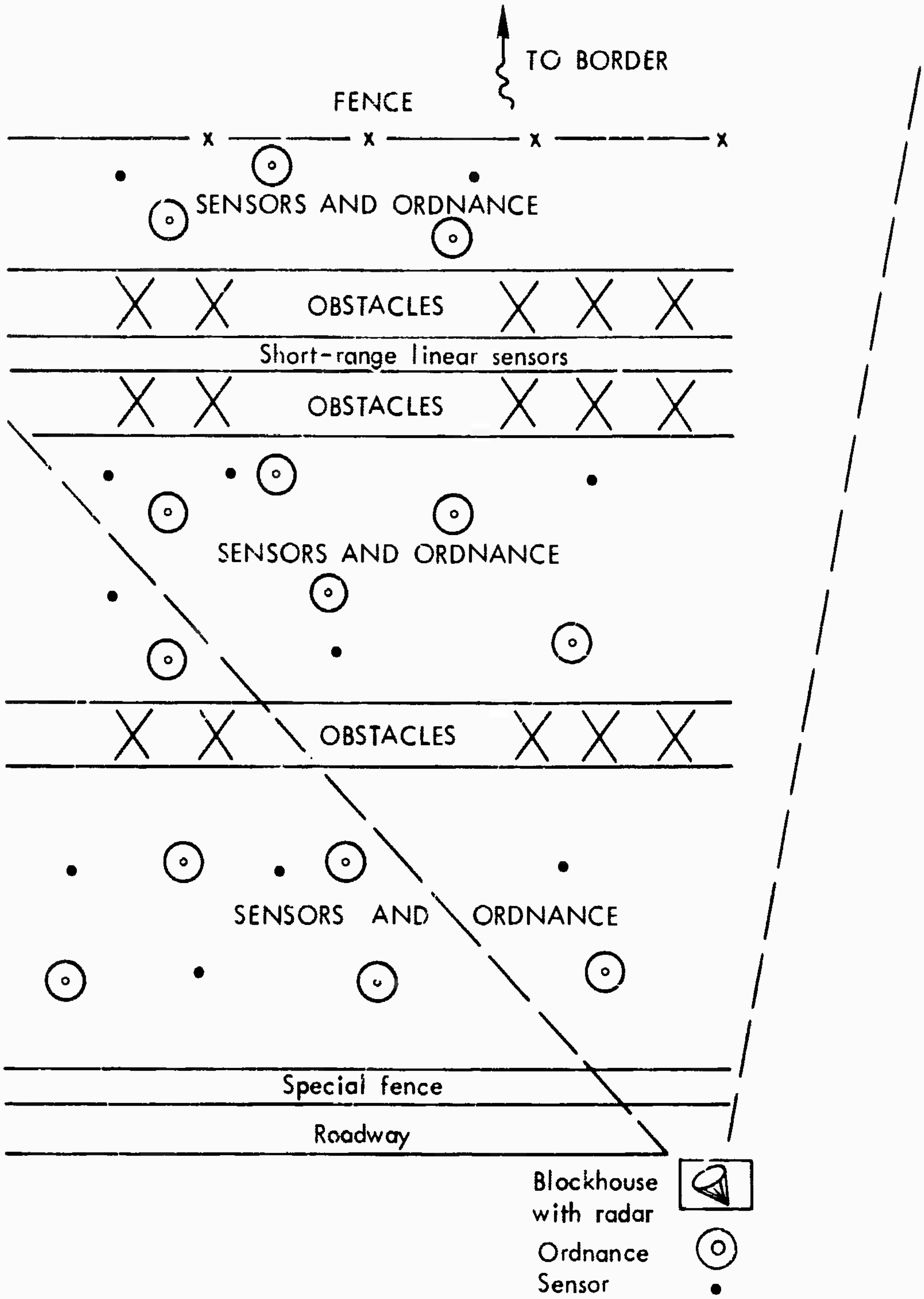

Fig. 13 — Schematic of barrier

(C) The cleared strip is feasible only on dry ground. The modules required in areas subject to inundation (Regions 9 and 10 under conditions of threat level III; see Fig. 1, p. 12) would be built on artificially elevated sections that will always remain above high water. As shown in Ref. 4, it is possible to follow existing berms, canals, a ' rivers for a considerable portion of the border in these areas. Additional berm and canal construction would be necessary in locations where there are no existing structures.

(U) Sensor Sub-System. For convenience, detection devices that might be used in the barrier are categorized according to their effective detection range as long-, medium-, and short-range sensors. Long-range sensors have personnel-detection ranges measured in hundreds or thousands of meters; medium-range sensors, in tens of meters; and short-range sensors, in meters. A suitable mix of these devices would provide an enhanced system detection performance and increase greatly the enemy's difficulty in devising effective countermeasures.

(C) Anti-personnel radars appear to be the preferable long-range sensors for the barrier, at least initially. However, there are disadvantages:

1) Radars are active (emitting) sensors and can be detected by infiltrating groups at relatively long ranges with simple receivers.
2) Radar antennas must generally be emplaced high above the ground if they are not to be masked by terrain features. This may make their location obvious to infiltrators even if the antennas are camouflaged.

(S) Medium-range sensors should be able to detect intruders with high probability at ranges of 10 to 20 meters, although some may have ranges of 50 to 60 meters. The particular combination of seismic, acoustic, electromagnetic, or magnetic sensors used in any section of the barrier would be determined by local conditions. All of these medium-range sensors include built-in logic allowing them to discriminate (to a degree) between an actual intruder and other spurious disturbances, thereby reducing the false-alarm rate. Generally, success

in reducing the false-alarm rate involves a compromise gain setting resulting in a reduction of the effective range of an individual sensor. The signal display in the blockhouses will indicate that the sensor threshold has been exceeded; but sometimes it may be desirable to display additional information--e.g., the audio output of an acoustic sensor for the human operator. Additionally, it will be desirable to display the simultaneous output of adjacent sensors since this has been found to be an efficient technique for validating a signature.

(U) For the short-detection ranges (a few meters), a balanced pressure system (BPS) that would sense foot pressure, or the multipurpose concealed intrusion detector (MCID) that senses local perturbations in the earth's magnetic field, would be candidates for the barrier. In general, these are linear systems that provide accurate intruder position data in one dimension. The fact that the BPS and MCID are buried sensors facilitates concealment. Moreover, if these short-range sensors are installed beneath the concertina barbed-wire obstacles of the barrier, they will be all the more difficult for infiltrators to find. Attempts to tamper with these obstacles could cause a pressure and/or magnetic disturbance which would activate the emplaced sensors.

(U) In selecting a suitable mix of sensors for the barrier system, it is recognized that any initial mix will be subject to continuing modification as experience is gained with sensor performance or with enemy intrusion attempts. The initial choice is based on subjective, as well as objective, assessment of sensor characteristics that are believed to provide a reasonable level of performance. Since the enemy must be expected to develop appropriate countermeasures, a continuing modification program will have to be maintained to minimize degradation in effectiveness.

(C) A reasonable initial mix of sensors would include an X-band personnel-detecting radar located near each blockhouse; an array of medium-range sensors, distributed and emplaced in the cleared strip; and, probably, two lines of short-range sensors. While any single sensor type is relatively easy to thwart, the differences in characteristics of a combination of sensors place stringent and conflicting

demands on the range of enemy countermeasures. Even if infiltrators were familiar with the operating characteristics of each sensor, they would have to defeat simultaneously seismic, electromagnetic, audio, magnetic, and perhaps other signatures.*

(C) Blockhouses and the Display of Information. Blockhouses would be located immediately behind the barrier. The portion of the barrier immediately in front of each blockhouse would be under visual as well as sensor surveillance. This section of the barrier would include moveable obstacles so that it could be used as the pass-through gate (check point) for traffic or for the exit and return of the SIP.

(C) Blockhouses would contain considerable conventional equipment required by any continuously manned facility (e.g., for eating and sleeping). They should also contain direct observational aids (e.g., periscopes, night-vision devices, etc.). In addition, there would be electronic communications, signal-processing, and information handling equipment, including at least one small digital computer. Blockhouses would be the equivalent of small tactical surveillance centers. As such, they could also incorporate selective read-out of data from existing border surveillance systems (DART, BASS, etc.) either directly or via the strong-point tactical surveillance center.

(C) The important feature of any blockhouse would be its sensor display and control facilities, which could take one of several forms:

1) Essentially a one-to-one spatial mapping of sensor and ordnance locations, e.g., a maplike display with lights representing active sensors and ordnance-firing pushbuttons at the locations of emplaced ordnance.

2) Display and control that are purely graphic descriptions of sensor activity and control functions; i.e., computer print-outs for sensor activations, and a

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*(U) Where terrain and visibility conditions permit, artificial illumination along the barrier could also significantly deter would-be infiltrators. Even though the barrier outlined in this report includes no artificial illumination, it may be a desirable addition at some later time.

more-or-less conventional keyboard for control of the emplaced ordnance. For example, monitoring personnel might type in code numbers or letters in order to detonate a particular piece of emplaced ordnance.

3) A display-and-control subsystem with some degree of spatial representation and/or abstract representation of sensor activity and control functions, e.g., any combination of 1 and 2 above.

(C) Whatever form the display-and-control subsystem in a blockhouse takes--they might be different from one portion of the barrier to another--the important point is that the human is the decision-maker. He would interpret the sensor outputs, evaluate the threat, and take whatever action considered appropriate.

(U) A recurring problem that arises with the use of large numbers of sensors is the incidence of false alarms, caused either by natural environmental factors or deliberately by the enemy. The incidence of such false alarms can be considerably reduced by paying proper attention to threshold signal intensities required to activate individual sensors, and to sensor integration. The use of a mixture of sensors with different operating characteristics, plus adequate system redundancy, should eliminate many of the operational difficulties experienced with previous single-type sensor fields. Moreover, the display and control system should present the data to the human operator so as to take advantage of his capabilities for pattern recognition, logical discrimination, and decision making. Several pertinent examples can be cited. Enemy mortar or artillery shells directed against the barrier would activate seismic and BPS sensors, but would not activate radars or magnetic sensors. The resultant lack of correlation of signals exhibited on the display panels in the blockhouses would be correctly interpreted by observers even if they were unable to monitor the scene visually. Electric disturbances caused by thunderstorms or electronic countermeasures should not have a significant effect on seismic sensors. If seismic disturbances are induced by such sources, the signals are likely to be of small amplitude and would be distributed

over large enough sensor areas so as not to cause any major confusion in the minds of the monitoring crews.

(C) Obstacles. The obstacle subsystem is intended to delay would-be infiltrators so that the possibility of both detection and response can be increased. Detection capabilities should be increased because:

1) The obstacle subsystem would cause intruders to use relatively long paths in crossing the barrier. They may, for example, move along the length of the obstacle subsystem looking for apparent weak points where crossing would be easier. As demonstrated in Ref. 23, long-path lengths increase the chances of detection.
2) An attempt to cut through or otherwise cross obstacles will generally require the expenditure of more energy than would be required in the absence of obstacles. The increased energy expenditure will usually show up as larger sensor signals, which should in turn increase detectability. As indicated above, one example of a signal-enhancing combination of sensors and obstacles is an MCID emplaced beneath concertina and barbed-wire fencing. Moving or cutting the wire should result in larger disturbances of the earth's field than would occur in the absence of steel obstacles.
3) The intruders are forced to spend more time in the cleared strip even if their paths are not changed. This longer dwell time increases the probability, once sensor thresholds are exceeded, that monitoring blockhouse personnel will correctly interpret the sensor signals as intrusions.

(U) More importantly, the chances for effective interdiction should be increased because the blockhouse personnel would have a longer time to choose and fire the emplaced ordnance in an optimum manner, as well as to alert the strong-point artillery and/or reaction force to respond to a pre-registered portion of the barrier.

(C) Finally, both detection and reaction effectiveness increase when the location of both the sensors and the ordnance can be concealed by the obstacle subsystem. The obstacle subsystem can serve to camouflage the sensors and ordnance, or to create "visual clutter," which could make it harder for intruders to locate the sensors and ordnance, even though they may be visible. If the sensors and ordnance cannot be located by intruders, they are likely to approach the sensors and ordnance more closely than they would otherwise. Close approach to sensors and ordnance will, of course, increase the chances of detecting and attriting the enemy.

(U) One type of obstacle could be the standard entanglement barrier. It is a combination of apron fencing and concertina providing an obstacle 9-meters wide. The barrier illustrated in Fig. 13 uses three of these 9-meter wide obstacles. A chain-link fence along the forward edge of the cleared strip is intended to reduce animal-induced false alarms and to act as a demarcation and warning line for innocent personnel.

(U) Communication Links. The effectiveness of the barrier will depend heavily on the proper functioning of the communications system that transmits information and commands among sensors, emplaced ordnance, monitoring blockhouses, strong-points, and helicopter bases.

(C) Several modes of communication are possible among the different parts of the barrier system. Sensor data could be transmitted over buried cables to the blockhouses, or by radio frequency (RF) links. Similarly, blockhouse commands to fire the emplaced ordnance could be transmitted by hard-wire or RF links. Both types of transmission have advantages and disadvantages for the type of barrier considered here. Hard-wire transmission can be more reliable, avoid the necessity for battery replacement in the sensors, conserve radio frequencies, and limit radio interference, jamming, or spoofing of the communications net. At the same time, hard-wire is vulnerable to purposeful enemy action, artillery or mortar fire, equipment, animals, etc. These advantages and disadvantages are largely reversed for RF transmission.

(C) In practice, a combination of communication modes would be desirable and should be incorporated in the barrier, particularly for

the sensor-blockhouse link. For the blockhouse-emplaced ordnance link, RF transmission, unless appropriately coded, could enable the enemy to blow sections of the ordnance field by use of the correct frequencies.* The communications subsystem would also have to be well-protected against direct attacks and be inherently reliable.

(U) Barrier Ordnance. The ordnance used in the barrier would consist of various types of standard mines, such as the M-14, M-16, or M-18 (claymore). Strips or fields of these mines, around such high-priority targets as military installations and friendly troop positions, are widely accepted as a defensive measure against enemy ground troops or surface vehicles. Mine fields are not intended to deter a resolute enemy indefinitely, but rather to delay considerably his advance until he can clear a path, or to force him to reroute troop movements so as to by-pass the fields. Although useful in conventional military campaigns, their effectiveness against covert, low-level infiltration by highly trained units has proven unsatisfactory. The infiltration of such personnel could be more effectively countered with remotely actuated, controlled-fragmentation mines emplaced in clear areas or strips.

(C) For this type of application a modified version of the claymore mine, set for full-circular (360°) coverage, instead of the usual 60° pie-shaped arc, is suggested. To provide a multiple-detonation capability, the mines can be assembled in vertical stacks of four mines per stack, and the stacks hand emplaced.** Individual mines, or the top mines in a number of adjacent stacks, can be activated on command from the blockhouses (either via buried cable or RF link) to pop up to a height of 2 to 3 ft above ground prior to detonation. Figure 14 shows a possible design for this "repeating" claymore mine.

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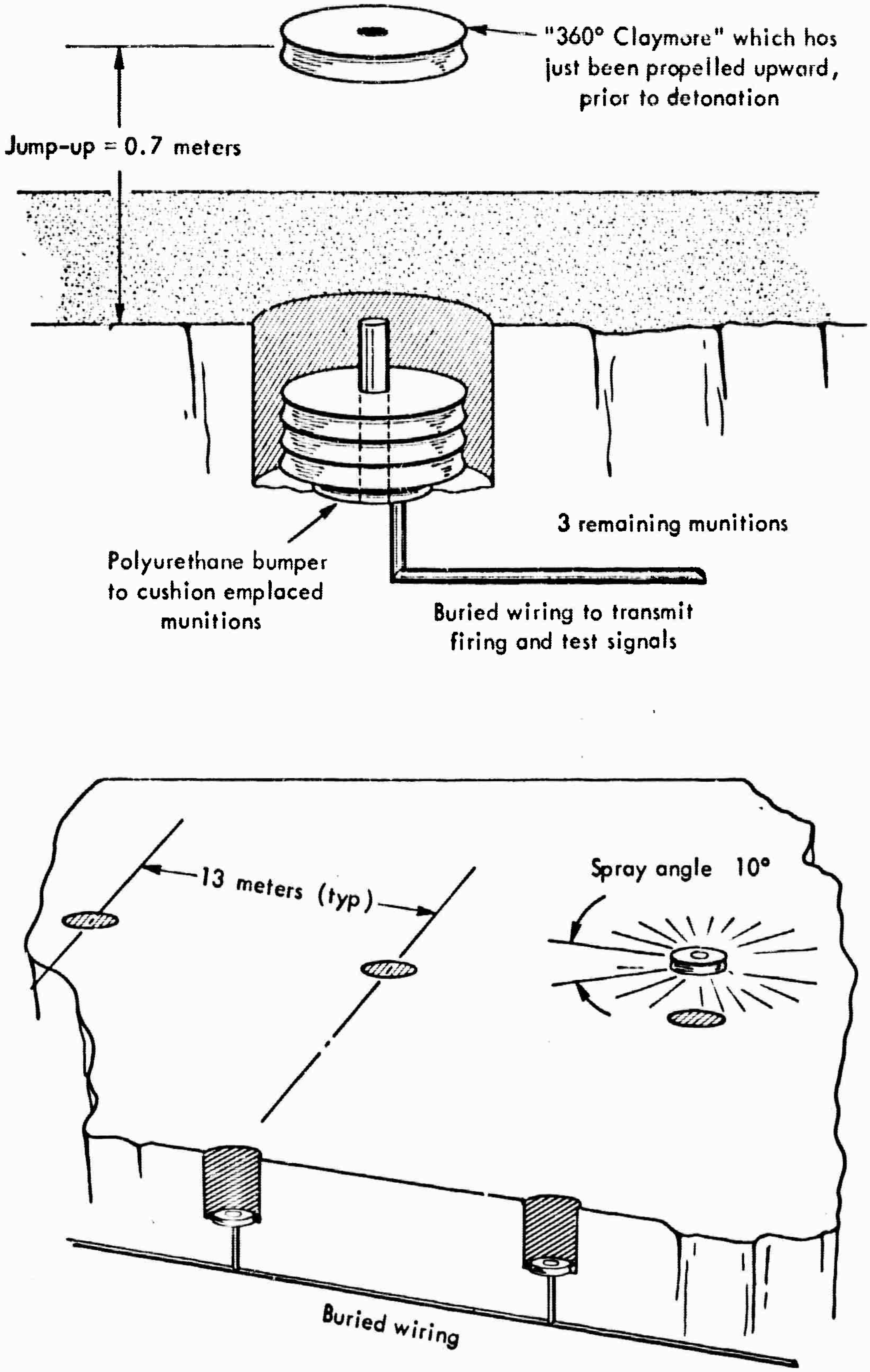
*(U) Although buried wire is used in estimating the cost of the barrier, it should not be construed as the preferred mode.

**(C) This type of "repeating" claymore does not exist, but preliminary analysis indicates that it is a feasible adaptation of existing weaponry.



(C) Fig. 14 — Emplaced ordnance (U)

ESTIMATED COST OF THE BARRIER SYSTEM

(C) The barrier portion of the barrier system can vary in width, number, and types of detection devices, obstacles, and emplaced ordnance depending on the threat, terrain, and other conditions. For cost estimating, the specific configuration sketched in Fig. 13 (p. 94) is used. This configuration consists of:

1) A chain-link fence along the forward edge to prevent accidental entrance;
2) Three 9m-wide rows of triple-concertina barbed wire;
3) One line of short-range sensors;
4) Three bands of medium-range sensors and emplaced ordnance of the "repeating" claymore type;
5) A rear fence acting as a sensor;*
6) A rear roadway to facilitate movement of maintenance and reaction forces.

(C) The estimated costs of the specific configuration for dry-land installation are displayed in Table 18 and described below.

1) The barrier incorporates a cleared strip of land approximately 150m wide. The amount and difficulty, and consequently the cost, of land clearing will vary in different regions of the border. As an estimate, a uniform cost of $800 per acre is used. This is considered to be on the high side since it is based on U.S. contractor costs for clearing relatively rough terrain. (The use of specialized equipment in South Vietnam--e.g., ROME plows--has demonstrated efficient and rapid land clearing methods costing considerably less than the $800 per acre estimated here. In addition, the use of local labor would result in lower cost.)

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*The Advanced Research Projects Agency and DCPG have tested this type of device.

(C) Table 18

ESTIMATED COST OF BARRIER INSTALLATION FOR A 16-KILOMETER MODULE (U)

Item	Cost ($ Thousands)	
	First Year	Recurring
1. Land Clearing	480	---[a]
2. Demarcation Fence	64	---[a]
3. Barbed-Wire Obstacles	1250	---[a]
4. Sensors		
Long-Range	105	35[b]
Medium-Range	2880	1000
Short-Range	928	200[c]
5. Ordnance	800	---[d]
6. Blockhouse	150	---[a]
7. Communications		
Equipment	450	150[e]
Cabling	48	10[c]
	7200	1400

[a] Maintenance assumed to be within existing capabilities of military forces.

[b] One radar replaced each year after first year.

[c] Approximately 20 percent replacement due to damage from ordnance or weather.

[d] Replacements included in ammunition cost of entire barrier system.

[e] Assumes continuing substitution of advanced data-handling equipment.

For the barrier module, a 150 by 16,000m strip at \$800 per acre ($4047m^2$) would cost approximately \$480,000.*

2) The fence installed along the forward edge of the barrier is standard chain-link. A generous estimate of the cost, including installation at the time of land clearing, is \$4000 per kilometer (\$1.22 per ft). For 16 km, the total cost would be \$64,000.

3) The triple concertina obstacles with aprons are standard military installations. At \$26,000 per kilometer,(4) the total cost for three rows of such obstacles, including installation, would be \$1,250,000 per barrier module.

4) Estimates of the cost of the three types of sensors used in the barrier depend on the specific type used. The following are considered reasonable.

(a) The long-range sensors would be modified or advanced versions of the PPS-5 or PPS-6 antipersonnel, moving-target indicator radars. At an estimated cost of \$35,000 each, and assuming one radar at each of the three blockhouses, the total cost would be \$105,000.

(b) The medium-range sensors would consist of a combination of seismic, magnetic, and electromagnetic sensors in the ratio of 50:25:25. An

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*(C) Although a small fraction of the total system cost, this is an important contributor to the efficiency of the system since it forces infiltrators into the open for at least a short period of time. Nevertheless, there is apparently a psychological reluctance in military circles to consider such extensive land clearing. This reluctance is surprising because land clearing is a common activity throughout the world, including South Vietnam; and land-clearing techniques using such equipment as ROME plows, tree-crushing machines, or tree-eating machines have been highly developed by the U.S. construction industry in freeway construction, housing developments, etc.

average cost of $1440 per item has been assumed for these devices (see note, Table 14, p. 77). A detection radius of 20m (for a probability of detection approaching 1.0) has also been assumed. On this basis, a row of sensors spaced 32m apart (allowing some overlap in the detection) would require 500 sensors for each line in the 16-km module. Three lines of sensors, one associated with each band of "repeating" claymores, would require 1500 medium-range sensors. Also, assuming an annual replacement rate of 33 percent, the total number of medium-range sensors required per module would be approximately 2000.* At $1440 each, the total cost would be $2.9 million.

(c) Any of the short-range detection devices--the BPS, MCID, or the "special" fence--is estimated to cost about $29,000 per kilometer ($8.84 per ft), including installation at the time the barrier strip is cleared. Two such lines of short-range detection devices, one of the BPS/MCID type buried under the edge of the concertina wire, and one of the "special" fence type at the rear of the barrier, would cost $928,000.

5) The emplaced ordnance, consisting of "repeating" claymores, is estimated to cost about $200 per unit.** Using a 10m radius for an 0.8 probability of disabling any infiltrator, the number of

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*(C) This replacement rate is a crude estimate that assumes replacement of the hand-wired sensors due to damage by water, animals, enemy or friendly ordnance, etc. Alternatively, it could represent replacement of only the batteries if hand-wired emplacement is not used.

**(C) Based on a preliminary design in which each 360° disc of the "repeating" claymore has essentially the same explosive and pellet charge as a standard claymore mine (which has a 60° spray angle and a cost of about $20). The additional amount is an estimate of the cost of the "pop-up" mechanism and electric firing device.

"repeating" claymores required for five 16-km rows comes to 4000 at a total cost of $800,000.

6) The individual, protected blockhouses for housing 15 troops--including living and sleeping facilities and power generation equipment but excluding the associated communications, computer, and display equipment--are estimated to cost about $50,000 each, or $150,000 for the three blockhouses per module.

7) The blockhouse equipment, including the small computer, display devices, and firing terminals for the emplaced ordnance is estimated to cost about $150,000 per blockhouse, or $450,000 for the three blockhouses in each module.

8) For costing purposes, the communications system between the sensors, blockhouses, and "repeating" claymores, is assumed to be the buried-wire mode. A redundant bus system, using multiple looping, requires 45 km of buried cable in each 16-km sector. Based on a net average cost of $3000 per kilometer of barrier for installation and materials, the total cost is $48,000 ($0.91 per ft of barrier).

(C) As indicated in Table 18 (p. 94), the total cost of the barrier portion of the barrier system is $7.2 million for the first year and $1.4 million for each following year. To these costs must be added the costs of the strong-point system to obtain the full system cost. The first-year costs for the full barrier system in a 16-km module on dry land would be $12.7 million; recurring costs would be $4.2 million. Manning l vels, as in the strong-point system, would be 1677 per module.

Barriers For Inundated Areas

(C) As indicated above, a barrier-system module for the border areas subject to flooding (Regions 9 and 10; Fig. 1, p. 12) could, with

minimum effort, be constructed on some of the existing berms in these areas. In other areas, the berm itself would have to be constructed and some of the canals and other waterways rerouted. Reference 4 presents an estimate of the cost of such construction for the Delta areas of South Vietnam.

(C) For a 16-km module, construction of an 84m-wide berm, plus the addition of one control gate or "pass-through" in each module, would cost an estimated \$1.92 million for the berm* and \$0.2 million for the control gate. The substitution of the 84m berm for the 150m cleared strip in a dry-land module would save the cost of land clearing (\$0.48 million). It would also create a narrower strip and require either a barrier with less equipment or with more closely spaced rows of sensors, obstacles, and ordnance. This study uses the second alternative in estimating the barrier cost.

(C) The 16-km barrier module for areas subject to flooding would thus cost the same as the dry-land module with the addition of \$1.92 million for the berm and \$0.2 million for the pass-through, less the strip clearing cost of \$0.48 million--a net increase of \$1.6 million.** Assuming that the maintenance of the berm, as with the cleared strip, would be within the capabilities of the local military forces, these estimates would be first-year costs only. Prorating the costs over five years, the total annual system cost of a 16-km, dry-land module and a 16-km "wet"-land module are shown in Table 19.

(C) Table 19

TOTAL ANNUAL SYSTEM COST FOR 16-KILOMETER MODULE (U)

Manning	Cost (\$ Millions)	
	Dry Land	"Wet" Land
1677	5.9	6.2

*(C) The estimate in Ref. 4 is based on dredging and berm construction at U.S. contractor costs.

**(C) In addition, one infantry company of the strong-point battalion and some of the helicopters might be replaced by a boat company for use in either patrol operations or as part of the quick-reaction force. Lacking adequate data, this substitution is assumed to result in no change in the overall battalion costs or manning level.

(C) Compared with the estimated cost of the strong-point system module without a barrier (see Table 16, p. 79), the barrier-system module costs over 75 percent more per module. For a complete system along the entire relevant land border, the manpower level and estimated annual cost on a five-year basis is presented in Table 20, which also repeats the estimated cost of the strong-point system for comparison. For greatest effectiveness, these would be superimposed on the enhanced surveillance system costs, $28 to 41 million, depending on the threat level.

(C) Table 20

ESTIMATED MANPOWER AND ANNUAL COST OF COUNTRY-WIDE STRONG-POINT SYSTEM WITH AND WITHOUT BARRIER (U)

Threat Level	Manpower	Cost ($ Millions)[a]	
		No Barrier	Barrier
I & II	106,000	216	384
III	151,000	312	551

[a]65 modules of dry-land barrier plus 27 modules of barrier in areas subject to flooding; two additional modules have been allowed for the construction of additional helicopter bases.

EFFECTIVENESS OF THE MANNED BORDER SECURITY SYSTEMS

(U) In attempting to provide some quantitative assessment of effectiveness for the manned border security systems, it is recognized that performance will be influenced by many factors--e.g., the training and morale of the forces, the type of equipment they have, the conditions under which they fight. By and large, attempts to measure the effectiveness of systems heavily dependent on human performance are, at best, oversimplifications of the real world. They yield gross approximations of performance under specific conditions. The innumerable conditions and circumstances of enemy action, terrain, fighting conditions, etc. influence the actual effectiveness of combat troops. We have developed our mathematical effectiveness models with these limitations in mind.

(U) The overall mission or function of border security operations is to prevent the crossing of the border area by unauthorized persons. The two main components of such operations are surveillance and interdiction. For our purposes, surveillance--regarded as an activity undertaken to determine or detect the presence of enemy personnel--is measured in terms of the chances of detecting such personnel; i.e., the probability of detection, signified by P_d. Interdiction is a general term that includes attrition or disablement of the enemy, capturing the enemy, harassing the enemy, or any activity which forces him to discontinue the immediate attempt to infiltrate. Quantitatively, interdiction is represented by the chance or probability of attriting or disabling the enemy, signified by P_k. The effectiveness of any border-control technique is the product of detection and attrition (disablement):

$$E = P_d \times P_k$$

(U) For purposes of analyses, the detection component of each operation of the system is separated from the attrition component. These components are subsequently combined. Under detection components, the following aspects are discussed:

1) Detection by surveillance-interdiction patrols;
2) Detection by area security patrols;
3) Detection by quick-reaction forces;
4) Detection by the barrier sensors.

(U) Under attrition components the following aspects are presented:

1) Attrition by surveillance-interdiction patrols or by area security patrols using ambush techniques;
2) Attrition by quick-reaction forces;
3) Attrition due to artillery;
4) Attrition due to air strikes;
5) Attrition by emplaced ordnance in the barrier.

(U) In each case, the analysis attempts to identify the main factors influencing the performance of the components and is undertaken in terms of these factors. Finally, the components of both

the detection analysis and the attrition analysis are combined to provide overall effectiveness assessments for particular operations and types of threats. Under the assumptions and conditions stated, illustrative cases describe the effectiveness performance of the two manned border security systems.

Detection Components

(S) Detection by Surveillance and Interdiction Patrols. The Surveillance and Interdiction Patrols (SIP) are specially equipped units that carry sensors and ordnance of various types. Their primary mission is to establish ambushes in the border areas. They may operate in forested border areas where the enemy uses trails, streams, etc. as infiltration routes; or they may operate in relatively open terrain, particularly at night.

Jungle Terrain

(U) To estimate the effectiveness of the SIP in monitoring trail systems, divide the spectrum of possibilities into the following cases:

1) The number of routes, (N_r), is less than (or equal to) the number of patrols, (N_p). Under such circumstances, each route will be monitored by at least one SIP and the detection probability, (P_{ds}), will be at least P_{dd}, the detection probability of one SIP in a direct monitoring mode; i.e.,

$$P_{ds} \geqq P_{dd} \text{ for } N_r/N_p \leq 1.$$

Considering that each SIP will be equipped with emplaced sensors for detecting infiltrators, and will in addition receive early warning "intelligence" from the enhanced surveillance system, and will in addition utilize their own senses augmented by portable radars, NODs and SLSs, P_{dd} can be

expected to be quite high.* For estimation purposes in this study, we use the value of 0.95 for P_{dd}.

2) SIP operate in both a direct monitoring mode and a remote monitoring mode where μ is the ratio of remotely to directly monitored routes. If the detection probability on a remotely monitored route is P_{dr}, then

$$P_{ds} = \frac{P_{dd} + \left(N_r/N_p - 1\right) P_{dr}}{N_r/N_p} \text{ for } 1 \le N_r/N_p \le \mu + 1.$$

Although the same considerations apply to P_{dr} as to P_{dd}, except that the direct sensing backup is missing, we will treat P_{dr} parametrically. In practice, for six sensors monitoring each trail, P_{dr} will be in the neighborhood of 0.8 to 0.95.

3) SIP operate in both a direct monitoring mode and a remote monitoring mode, but the number of routes exceeds the number monitored; i.e.,

$$P_{ds} = \frac{P_{dd} + \mu P_{dr}}{N_r/N_p} \text{ for } \mu + 1 \le N_r/N_p.$$

(U) Figure 15 is a general representation of the system detection probability. In a specific example, for seven patrols in a direct monitoring mode on the 11 routes per 16-km module, and assuming that the balance of the routes are remotely monitored with a $P_{dr} = 0.8$, the system effectiveness is 0.89 (11 out of every 100 infiltrators would not be detected by the SIP). If $P_{dr} = 0.95$, $P_{ds} = 0.95$.

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*(U) If the number of sensors used per trail is n and the detection probability of each is 0.5, then $P_{dd} = 1 - (1-0.5)^n$. Therefore, for $P_{dd} = 0.95$, on the average only 4.3 sensors would have to operate independently of each other. Conversely, for the six sensors per trail contemplated, the effectiveness of each could be less than 0.4 for an overall $P_{dd} = 0.95$.

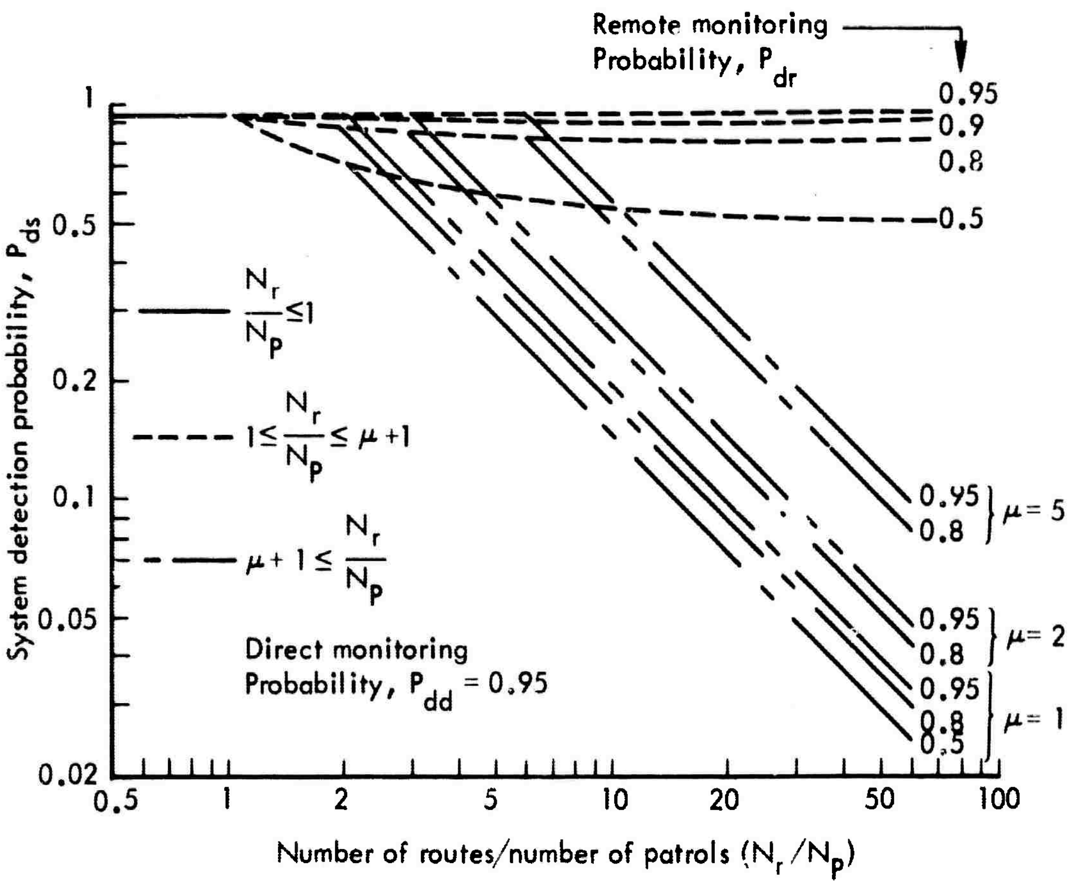

Fig. 15 — System detection probability for surveillance-interdiction patrols in trail monitoring mode

Open Terrain

(U) The second case considers the operation of SIP in relatively open terrain. Here we are concerned particularly with situations in which the SIP set up positions to detect the movement of infiltrators through open areas at night. In these situations, the enemy is not confined to specific routes but can arbitrarily select his crossing path; i.e., his movement is not restricted to a jungle trail or waterway. Such a situation might be characteristic of movement through some of the areas of III CTZ and IV CTZ (i.e., Regions 9-10). It is especially important in these cases that confirmation of target validity be provided since the border areas are heavily populated with civilians.

(C) The SIP are equipped with portable long-range sensors (starlight scopes and radars) as well as with medium-range sensors for remote emplacement. From Ref. 24, it can be ascertained that the starlight scope (SLS) has detection radii of 100 to 500m, depending on the background illumination, surface roughness, and other factors. Similarly, detection radii for portable MTI radars (equivalent to the PPS-5) range from 100m to 2 km. Under the worst conditions, assuming two SLSs and one radar per SIP, seven SIP per 16-km module (and no overlap between sensors), the probability of detecting an intruder entering the module at any point along its border would be

$$\frac{21 \times 200}{16,000} = 0.26;$$

under the best conditions, this probability would be near-unity with the radars accomplishing virtually all the detection. Under usual circumstances, however, the likelihood of detection would be closer to the lower number (primarily because of surface roughness).

(C) Since the foregoing set of circumstances is unacceptable, the SIP will have to rely on the early warning provided by the enhanced surveillance system to raise the detection probability in open terrain. The inset in Fig. 16 illustrates the dynamics of such an interception. The early warning system provides the SIP with an estimate of the "most likely intercept point" (MLIP). On the average, the

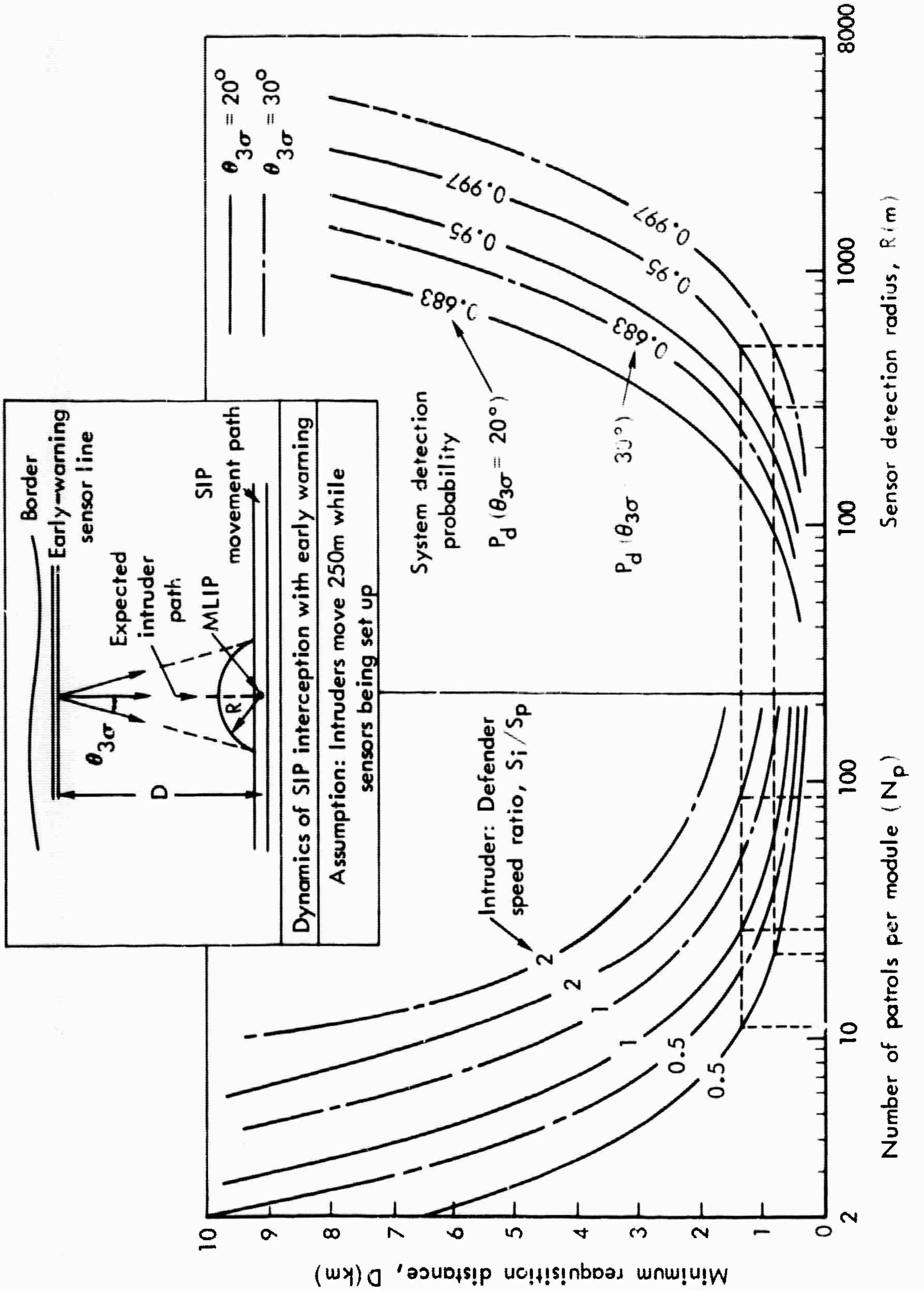

Fig.16 — Reacquisition distance and detection probability

SIP will require

$$\frac{16}{N_p S_p} + t_a$$

units of time to move to the MLIP and set up the sensors (N_p is the number of patrol equivalents per module; S_p, the speed of patrol movement; and t_a, the time to set up the sensors). The SIP should move along a path displaced a distance, D, from the early warning line so that the search will commence just as the intruders are entering the search area for the most likely intruder path (i.e., an intruder path of θ=0). Since this time is also

$$\frac{D - R}{S_i} = \frac{D\,(1 - \tan \theta_{3\sigma})}{S_i},$$

where R is the sensor detection radius* and S_i is the speed of the intruder, the nomograph of Fig. 16 (p. 105) can be constructed. The independent variables are S_i/S_p, R, and $\theta_{3\sigma}$. As an example, suppose the defenders have 500m sensors, and it is known from prior experience that $\theta_{3\sigma} = 20^\circ$ (99.7 percent of the time, the intruders move within $\pm$ 20° from the normal path). Then, for a speed ratio $S_i/S_p = 1$, about 26 patrols will be required per module at a distance D = 1.38 km. If the defenders move twice as fast as the intruders, 11 patrols will be required; and if they move half as fast, 86 patrols will be required. Alternatively, if 21 patrol equivalents are available (as for the average case in an open-terrain module), and $S_i/S_p = 1/2$, then sensors with a 290m radius will suffice at D = 0.8 km; or, equivalently, if 500m sensors are available, a $\theta_{3\sigma} = 30^\circ$ can be tolerated. As another example for D = 0.8 km and R = 195m, the system detection probability, $P_d = 0.95$; for R = 96m, $P_d = 0.68$.

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*(U) Here, for convenience of presentation, we define R as the radius where 100 percent detection is obtained from that sensor. In practice, one will know the radius where a specific detection probability less than one (e.g., 0.95) holds. In such cases, multiply the results achieved from Fig. 16 by that probability.

(C) In practice, effective utilization of the SIP to detect infiltrators will require a learning process to: 1) study the habits of the infiltrators (i.e., their speed and $\theta_{3\sigma}$); 2) ascertain the capabilities of the defenders (i.e., their speed and sensor radii). These will vary with the terrain and the weather so that a variety of contingencies must be provided for. In general, a speed ratio $S_i/S_p = 0.5$ is thought to be reasonable, especially if the SIP path is a trail or a road. Reference 24 implies that in the Korean DMZ area, a $\theta_{3\sigma}$ of 30^o is appropriate; but it is not known whether this is applicable to Regions 9 and 10 of South Vietnam. As pointed out in Ref. 23, it is advantageous to the infiltrator to spend a minimum amount of time in the search area; in Fig. 16, we have therefore displayed curves for $\theta_{3\sigma} = 20^o$ and 30^o and have included the $\theta_{2\sigma}$ and θ_{σ} curves to facilitate interpretation.

(U) Detection by Area Security Patrols. The area security patrols used in the strong-point system or the barrier system would operate in different modes depending on the type and particular location of the system. In relatively secure areas--i.e., areas where enemy attacks from the rear of the strong-point or the barrier are unlikely--these patrols would probably be deployed forward and between the strong-points. They would constitute a second screening force. In these cases, their effectiveness in detecting intruders is handled identically to that of the SIP. For areas in which enemy activity requires surveillance completely around the strong-points because of the possibility of mortar, rocket, or troop attack on the strong-point or barrier, the patrols might be deployed in a perimeter defense.

(U) We assume that area patrolling would be performed by units of approximately the same size as the SIP. They would patrol during the day and occupy ambush positions at night since this is the most likely time of enemy movement.

(U) More realistically, some of the area patrols would not be situated so as to search over the entire enemy path distribution. Considering the geometry of several possible deployments, it can be

shown that area patrols, on the average, will be between 50 and 80 percent as effective in detecting infiltrators as SIP. This degradation occurs because the SIP's only mission is detection of infiltration across the border, while the area patrols are also required to be alert to possible threats against the strong-points coming from other directions. The contribution of the area security patrols to the system detection probability is thus equivalent to augmenting the SIP coverage by 50 to 80 percent on the average. Figure 16 can thus be used for determining the combined system detection probability for the two types of patrols under the conditions stated for the SIP. For operation on trails the same rationale holds except, however, that Fig. 15 is used.

(U) Detection by Quick-Reaction Forces. In some cases, a SIP or an area security patrol will call for support from the maneuver forces at the strong-point or the helicopter bases. A portion of these forces are assumed to be quick-reaction forces (QRF) that are on alert and can be quickly transported to some part of the strong-point's area of responsibility to engage the infiltrators.

(U) If, for some reason, the SIP or the area security patrols have lost contact with the infiltrators, the QRF will have to re-acquire the infiltrators. Reacquisition effectiveness will be determined by the time required to reach the area, the extent to which the infiltrators have changed the direction of their movement, the terrain, illumination, and many other factors. Techniques similar to those used for computing the estimates of Figs. 15 and 16 will again suffice.* Time constants will be greater, however, because of the distances and transport equipment involved.

(U) In relatively open terrain, the effectiveness of a dispatched QRF will also depend on the extent to which it can break up into smaller teams to set up observation (and ambush) positions. For

*(U) If the QRF is committed against an infiltrating unit moving on trails, it may or may not reacquire the unit as a target depending on the speed of infiltrator movement and the time required for the QRF to reach the area.

example, if the total QRF dispatched is 120 men, they may break up into four or more smaller teams to increase their chances of contacting the enemy. The number of observation teams set up by a QRF will depend, among other things, on estimates of the size of the infiltrating enemy unit.

(U) Detection by the Barrier Sensors. As described above, the barrier's detection equipment consists of short-range sensors (e.g., BPS, MCID, and "special" fence), medium-range sensors (seismic, magnetic, electromagnetic, etc., or combinations), and long-range sensors (e.g., the anti-personnel, MTI radar). The three types of sensors form essentially five continuous "lines" of detection devices plus the radar. These six subsystems are assumed to provide a system detection probability of approximately 1.0. Theoretically, if each of the six lines of sensors operated independently with a P_d of only 0.54 (even though each individual line should actually have a much higher P_d), the system P_d would be $>$ 0.99.

(U) Such other considerations as false alarms or deliberate enemy countermeasures are discussed above (pp. 85-90).

Attrition Components

(U) Components of the various border security systems contributing to casualty production (attrition) are the SIP, the area security patrols, the fire-and-maneuver elements consisting of artillery and QRF, air support, and (in the case of the barrier) emplaced ordnance. For the effectiveness evaluation, the operations considered are:

1) Ambushes by the patrols or the quick reaction forces;
2) Artillery;
3) Air support;
4) Ordnance in the barrier.

(U) Attrition Effectiveness of Ambushes. Ambushes are one primary means by which the SIP, the area security patrols, and the QRF produce attrition. Ambushes would probably be used against at least two types of threats: the small groups of infiltrators (6) characteristic of threat type I; and the moderate-size infiltration groups (40)

characteristic of threat type II. Against the large threat (400 men), the SIP would be used primarily for detection and surveillance. Additionally, under some very special circumstances, their purpose could be to harass and delay large enemy units.

(C) For evaluation purposes, ambush models can be constructed that permit estimates of casualties on both sides. Typical models are described in Refs. 20, 25, and 26. All of these models postulate various force levels on opposing sides; list one or both sides' supporting weapons (claymores, artillery, air support) for various portions of the battle; and give the ambusher a large advantage in the early stages of battle. A general conclusion that follows from this work (supported by experience from SEA) is that in an equal-force ambush, the ambusher usually wins at relatively small cost to his side. When ambushers engage an enemy twice their size, the outcome is determined by the training, discipline, and tactics of the ambushees. If the ambushees are closely spaced so that a large percentage become casualties with an initial salvo of claymores, then the battle will be won by the ambushers.[20] If the ambushees are poorly trained and do not achieve suitable cover early in the battle, they are also likely to lose. However these battles often extract a large toll from the ambusher.[25]

(U) For estimation purposes, it is helpful to examine the parameters of a typical sample of small-unit ambushes that have occurred in South Vietnam. In Table 21, we list the initial forces and casualties of 34 such events drawn from a 1964 data base.[27] The data represent VC night ambushes against RVN forces. In most cases they are not sufficiently detailed to indicate whether or not the conflict was initiated with area weapons, but this is not an unreasonable presumption. This particular set of events did not involve air or artillery support for the ambushees.

(C) Table 21 provides insight believed applicable to the general situation that would prevail in a post-hostilities border control situation in SVN. First, not only were the VC of the time highly motivated and reasonably well-armed, but they also usually outnumbered their opponents (1.7:1 on the average) despite the fact that they had

(U) Table 21

A SAMPLE OF VC-INITIATED NIGHT AMBUSHES AGAINST RVN FORCES--CIRCA 1964[a]

RVN Force Size	VC Force Size	V/R	RVN Casualties[b]	VC Casualties
10	20	2	2	0
30	100	3.3	9	0
10	30	3	5	0
10	10	1	1	0
10	20	2	1	0
10	30	3	1	0
30	30	1	5	0
5	20	4	1	0
10	30	3	0	2
12	10	0.83	5	0
10	30	3	1	0
30	30	1	3	1
30	30	1	5	1
10	20	2	0	1
10	30	3	0	0
10	30	3	1	0
30	30	1	1	2
10	10	1	2	0
200	60	0.3	1	0
12	30	2.5	0	1
30	10	0.33	1	0
100	30	0.3	9	0
30	30	1	4	0
26	30	1.15	2	0
30	100	3.33	25	0
10	10	1	0	2
30	30	1	2	0
10	10	1	0	0
30	30	1	0	2
10	30	3	3	0
20	30	1.5	3	0
30	30	1	3	0
30	10	0.33	1	1
300	300	1	48	10
Avg 34.6	Avg 37.7	Avg 1.7:1		

[a]From MACV-J2 DISUMS and SITREPS as described in Ref. 27, p. 11 (nt.).

[b]Includes killed, wounded, and missing.

the advantage of ambush. Examination of a sample of 56 VC-initiated day ambushes reinforces this finding;(27) the average ratio in that case was 1.9:1. Friendly-initiated day and night ambushes were conducted under similar circumstance with initial force ratios of 2.1:1 and 2.4:1, respectively. Second (see Table 21), although the ambusher usually emerged from the conflict a clear victor, catastrophies where one or the other side was wiped out rarely occurred. Average RVN fraction casualties were 0.125; and average VC fraction casualties, 0.02. Examination of the 56 daylight ambushes reveal average RVN fraction casualties of 0.14 and average VC fraction casualties of 0.03.* Friendly day and night ambushes produced enemy fraction casualties of 0.18 and 0.07 (averaging 0.10) whereas friendly fraction casualties averaged 0.03. This consistent set of results (based on a total sample of 123 events), indicating ambushee casualties on the order of 10 to 15 percent, provides a good indication of the level of "resolve," as defined herein, which might pertain to ambush situations.** It can be inferred (based on the very low ambusher casualty levels) that the balance of the ambushees were (on the average) deterred from performing their particular missions.

(C) On the basis of the foregoing, we estimate that the 6-man SIP and area security patrols would be quite effective against the 6-man infiltration groups of threat level I. The most likely outcome of such an encounter would be one enemy casualty with the balance turning back. (The remaining infiltrators might subsequently return on the same or different trails, but these are counted as new infiltration attempts.)

(C) The SEA data do not provide much insight on the effectiveness of SIP against 40-man (threat level II) infiltration groups. They do indicate that such encounters have been quite rare. Our

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*(U) The daylight ambushes were conducted with forces roughly 75 percent larger, on the average.

**(U) However, other explanations of the relatively low ambushee casualties are possible. For example, no data exist on the level of casualties that would obtain if escape routes were blocked.

analytical models indicate that 6 well-prepared ambushers could constitute a considerable impediment to a 40-man infiltration patrol, sufficient to delay them until QRF (30-min) or artillery reinforcements arrive. We therefore treat the manned strong-point system as sufficient to attrit or deter both threat levels I and II with a high degree of effectiveness at only a small cost to the defenders (1 to 3 percent).

(C) Against large units, including those of 400-man infiltrating groups (threat type III), the analytical results indicate that a 6-man ambush would be suicidal. The use of such larger forces as the QRF or artillery fire and air strikes would be necessary, and the results highly variable. As will be shown below, such a response could easily achieve effectiveness levels of 50 percent or more if the SIP act as ground forward air controllers or artillery observers, correcting the fire based on their visual or sensor observations.

(U) In addition to routes directly monitored by the patrols, ambushes could possibly be conducted on remotely monitored routes. The ambushers would utilize claymores (and appropriate sensors), which they could fire initially, and then call for follow-on artillery fire. But this type of ambush has several disadvantages:

1) lack of confirmation of target validity;
2) inability to sustain the ambush fire with precision after the first volley;
3) lack of battle damage assessment.

Though this type of ambush will undoubtedly be used (probably frequently), it is questionable whether infiltrators would be deterred despite initial (perhaps 10 percent) casualties.

(U) <u>Attrition Effectiveness of Artillery</u>. As indicated in Sec. III, artillery fire is probably the most frequent response to sensor activations in current border security operations. Since circumstances vary considerably, its effectiveness is highly variable. For the case considered, we assume:

1) use of two types of 155m artillery shells--improved conventional munitions (ICM), and high-explosive (HE);

2) corrected fire by a forward observer who is a member of the ambush patrol.

The enemy troops can be in either relatively open or wooded terrain.

(C) Lethal areas for a single round of each type of 155mm shell are listed in Table 22 as a function of target posture.[28] The data are based on the five-min assault casualty criterion, requiring the disablement of unarmored assault personnel within five min. We estimate that the average between standing and prone personnel will be appropriate for the characteristics of infiltrating personnel.

(C) Table 22

LETHAL AREA[a] OF 155mm PROJECTILES (M^2) (U)

Terrain	Munition	Target Posture		
		Standing	Prone	Foxhole
Open	ICM	4460	3130	301
	HE	1240	939	130
Wooded	HE	552	292	34

[a]Five-minute assault casualty criterion.

(C) Table 23 lists the remaining parameters assumed in the artillery calculations.[28] The calculations assume both munition

(C) Table 23

155mm HOWITZER WEAPON DELIVERY PARAMETERS (U)

	Minimum Range[a]	Maximum Range[b]
	(7.0 km)	(17.4 km)
Prediction CEP_p (m)	62	154
Random CEP_r (m)	35	54
Total CEP_t (m)	71	163
ICM Radius of effect (m)	60	80
HE Radius of effect (m)	30	30

[a]Approximate distance to border point opposite strong-point.

[b]Approximate distance to border point opposite adjacent strong-point.

patterns and targets to be circular "cookie-cutters." Assuming individuals comprising the target disperse so that each occupies an area 18 by 18m, a 25m target radius can be calculated for the 6-man infiltrating group of threat level I, 65m for the 40-man groups of threat level II, and 204m for the 400-man groups of threat level III.

(C) Assuming prediction and random errors are independent of each other, and that the prediction errors remain largely uncorrected after the first round due to the distributed nature of the targets, it is possible to calculate the "lower-bound" attrition effectiveness of 155mm howitzers against personnel.* Such data are displayed in Fig. 17. Results are displayed for both ICM and HE, at minimum and maximum ranges, in open terrain for the ICM and wooded terrain for HE.

(C) Figure 17 makes clear that in open terrain artillery would constitute a powerful deterrent to infiltrators even under the worst conditions. Thus, 400-man groups (target radius = 204m) would incur casualties of 50 percent or more for only 25 rounds of ICM.** Since a battery of three tubes could fire 25 rounds in only 2 min, and since open terrain represents optimal conditions for accuracy correction, the manned strong-point system in such terrain can be considered quite effective against all threat levels. In wooded terrain (where ICM loses effectiveness), 155mm HE artillery would be quite effective against the smaller targets (6 and 40-man groups) requiring 40-50 rounds (less than 5 min of fire for three tubes) for 50 percent attrition. The 400-man groups would require 220-250 rounds, about 10 min of sustained fire, for 50 percent attrition. This extended period of

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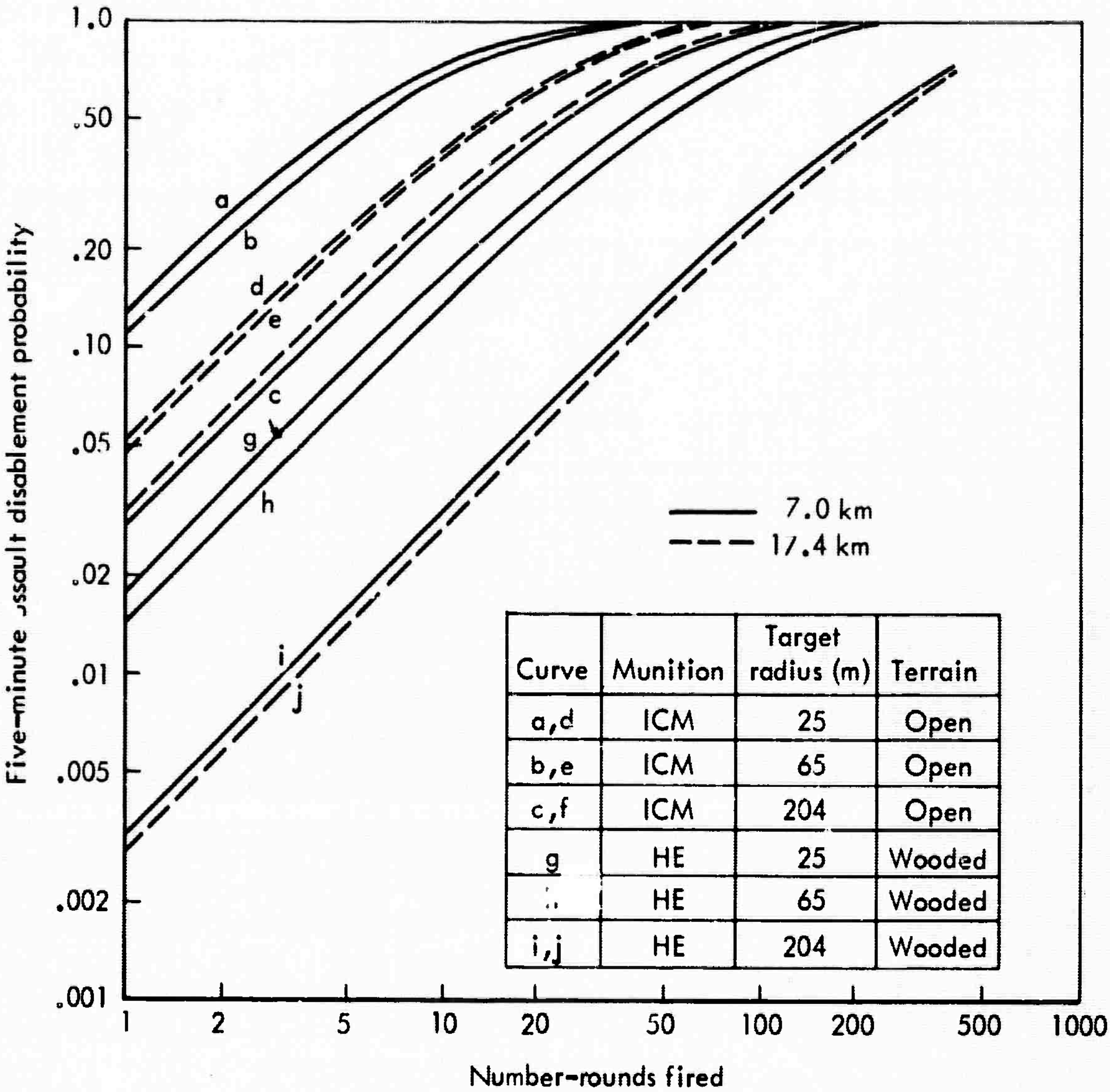
*(U) In practice, assuming the SIP act as forward observers, the prediction errors should decrease for subsequent rounds. They will not decrease to zero, however, because of observation errors by the SIP and because the target is not a point (i.e., its components are distributed throughout an area).

**(U) The appropriate level of "resolve" for infiltrating groups exposed to artillery fire is unknown. It is considered to be higher than that for ambushes (10-15 percent), probably of the order of 20-30 percent. Our calculations are conducted conservatively at the 50 percent level.



Curve	Munition	Target radius (m)	Terrain
a,d	ICM	25	Open
b,e	ICM	65	Open
c,f	ICM	204	Open
g	HE	25	Wooded
[illegible]	HE	65	Wooded
i,j	HE	204	Wooded

(C) Fig.17 — Effectiveness of 155mm artillery (U)

time, and the reduced ability of the SIP to observe the fire because of trees, might allow the infiltrating group to leave the target area. If the infiltrators choose to continue their mission, they partially defeat the manned strong-point system, at least temporarily. As a rough estimate, they sustain 25 percent casualties, and then continue on or turn back. If deterrence at this point occurs with probability 0.5, the manned strong-point system would have been about 62 percent effective exclusive of interdiction by QRF or subsequent air attack on the remaining 300 infiltrators. Detailed calculations illustrating the effect of QRF appear below.

(U) Attrition Effectiveness of Air Support. As with artillery, a variety of conditions influence the effectiveness of air support: the timeliness of aircraft arrival, the size and observability of the target, the type of aircraft, the type of ordnance, the nature of the target, etc.

(C) For effectiveness calculation purposes, we have restricted our estimates to the CBU-25 and the Caesar's Ghost munition. Of the various munitions considered, these two have a high effectiveness against personnel in both open and wooded areas. The CBU-25 is an inventory item, containing 132 BLU-24 A/B jungle bomblets. Caesar's Ghost is a conceptual rocket munition with a flechette warhead (described above, p. 51) with capability against both personnel and materiel targets. Both are compatible with the ground-attack aircraft programmed for the VIM (F-5s, A-37s); and Caesar's Ghost would also be compatible with the AH-1 armed helicopter.[21]

(C) Figure 18 shows results of the calculations. Against troops in open or lightly wooded areas, little difference exists between the CBU-25 and the 20-lb warhead Caesar's Ghost variation. Against troops in heavily wooded areas, the CBU-25 would be the better weapon provided the accumulation of "duds" does not prove a problem.*

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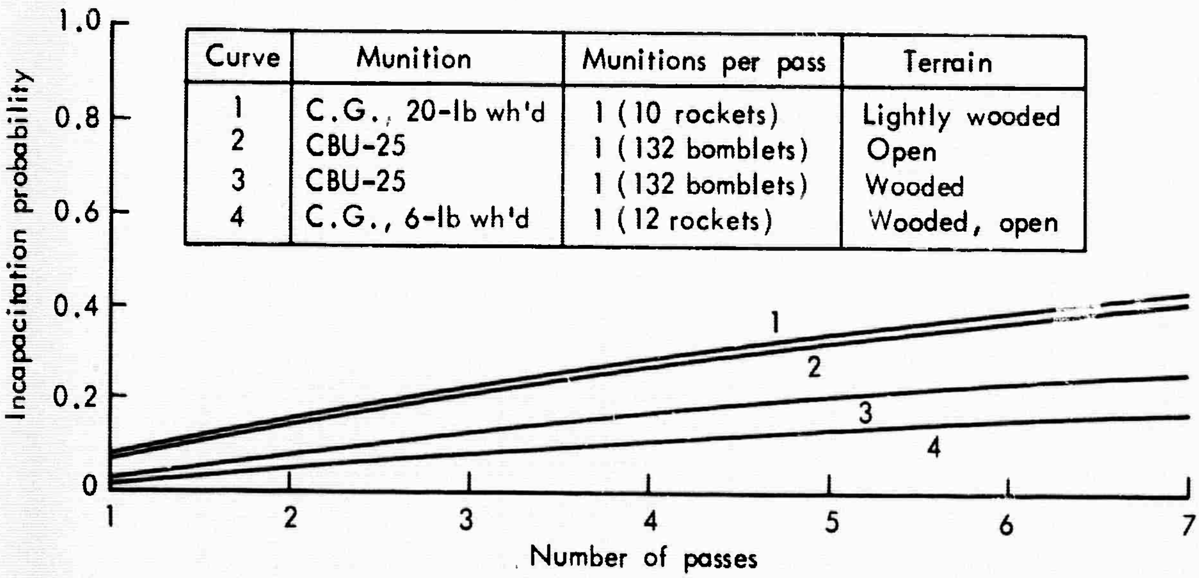
*(C) Dud rates for CBU munitions are usually of the order of 3-5 percent. After a large number of strikes in a restricted area (say the 160,000 M^2 of Fig. 18), the accumulation of duds can make the area unusable. For example, 1000 munitions dropped would leave from 4000-6600 duds, one every 25-40 sq m.



(C) Fig.18 — Effectiveness of air-delivered munitions[a] (U)

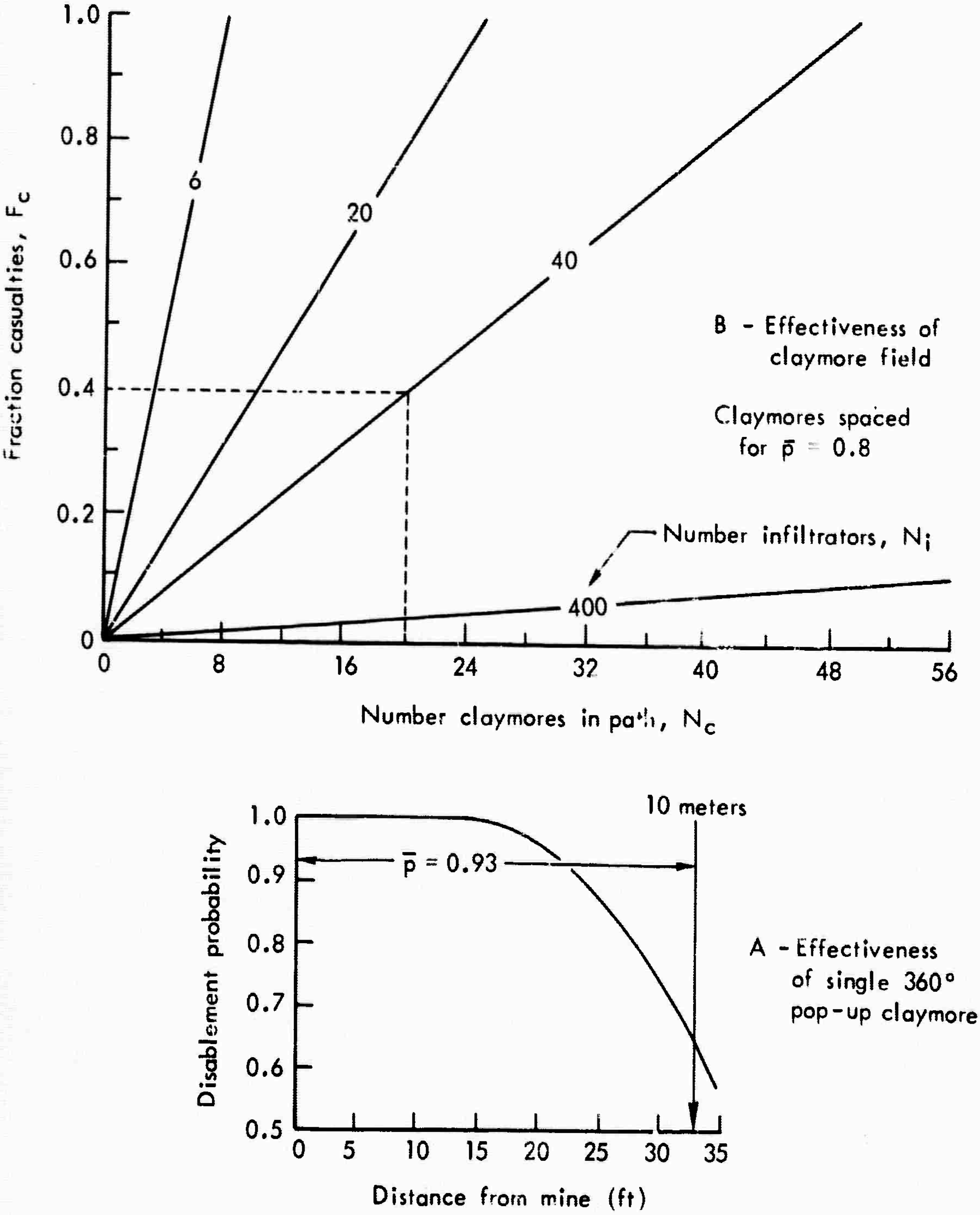
[a] Five-minute assault casualty criterian against prone troops in a 400 x 400 m square. CBU-25 data from Ref. 5; Caesar's Ghost data from Ref. 21

(C) The main difficulty with tactical air support for the manned strong-point or barrier systems against threat level III is that in the absence of an air alert, aircraft require an average of 30-60 min to arrive in the target area and drop ordnance. During this delay, it is unreasonable to expect the SIP or area security patrols to maintain contact with a 400-man infiltrating group in forested areas. Therefore, unless backup sensor fields were placed in the path of the infiltrators, reacquisition would be a severe problem. Such "air-monitored" sensor fields might in fact be highly effective in restricted, heavily-traversed routes like the A Shau Valley; but this mode of operation is not considered in this study.

(C) Attrition Effectiveness of Barrier Ordnance. The emplaced ordnance in the barrier consists of a stack of four 360° claymores that "pop up" individually and detonate. The effectiveness of a single detonation depends on the number, size, and velocity of the claymore fragments, the spatial geometry within which they are propelled, and the location, exposed area, and duties of the targets. We examined a large number of variations on the design sketched in Fig. 14, and selected the following parameters as being near-optimum for a 3-lb munition:

Weight of high explosive: 1.3 lbs
Total weight of fragments: 1.1 lbs
Fragment velocity: 5700 ft/sec
Individual fragment weight: 8 grains (962 fragments)
Spray angle: 10° downward from horizontal, inclusive
Burst height: 2.5 ft

(C) Figure 19A displays the effectiveness of a single claymore against a prone infiltrator in the 30-sec assault sense. Disablement probability is shown as a function of distance from the mine out to 35 ft. The average P_k to a distance of 10m (32.8 ft) is 0.93. However, this is for ideal operation (no error in jump-up distance, no tipping degradations, and 100 percent reliability). Taking such degradations into account, we estimate the average P_k to 10m at 0.8. Figure 19B displays the effectiveness of an array of such mines against



(C) Fig. 19 — Effectiveness of barrier ordnance (U)

various numbers of infiltrators. Illustratively, if 40 infiltrators attempt to breach the influence area of 20 claymores, the fraction casualties will be 0.4.

SYSTEM EFFECTIVENESS AGAINST THREATS

(U) The preceding computations deal with the effectiveness of detection and attrition components of the border security system in a general manner. As is evident, a host of factors will influence system effectiveness: e.g., whether the forces are operating in relatively open terrain or on jungle trails; whether these are a few or many trails; whether illumination is moon- or starlight; whether the forces are using sensors, starlight scopes, and other devices; whether the artillery fire is corrected or uncorrected; whether HE or ICM munitions are used; whether the enemy has penetrated deeply since last contact; whether the air ordnance is delivered against a target in a small area or a large area. In addition, as indicated above, local military commanders have many options for using their forces; and the manner in which they are used will influence the results of an operation.

(U) Because of the variety of factors--both analytical and real world--it is unlikely that any single set of conditions can be used to provide an estimate of overall system effectiveness.

(U) In estimating system effectiveness, we consider the detection and attrition functions of each part of the total system (SIP, area security patrols, reaction forces, etc.) as a series of events that combine to provide an estimate of overall effectiveness. The procedure uses probabilities of detection (P_d) and attrition (P_k) using the calculation techniques already presented. These probabilities are applied to the different functions of the system in terms of a sequence of mean-value events, which are described in each case.

(U) Each of the three types of threats described in Sec. III is considered for both the strong-point and the barrier system. However, instead of calculating the effectiveness of a specific system module against one of the threats, the calculations are based on the performance of individual system modules prorated for the entire border.

Thus, the performance of one module against one particular threat is taken as characteristic (on the average) of all such modules against the same threat.

(U) In addition to the six basic cases, we also consider variations in the average trail density and the timely availability of QRF. These variations constitute a sensitivity analysis lending credibility to the overall conclusions.

(C) Case 1: Threat Level I Against Strong-Point System. The basic assumptions for this case are:

1) The enemy will attempt to infiltrate 100,000 men during the year. (More precisely, there will be 100,000 infiltration attempts.)
2) The infiltrators will attempt to penetrate in 6-man units.
3) Ninety-nine percent of the infiltrators (99,000) will come through areas of jungle or covered terrain and 1 percent (1000) will come through areas of relatively open terrain.*
4) Eleven routes pass through each module with jungle terrain. This is the average number of identified routes for the country as a whole; as an estimate for the jungled areas, it is conservatively on the high side.
5) The resolve of infiltrators in situations in which they are in direct contact with defenders is 15 percent. If they are remotely monitored, or interdicted exclusively with artillery or tactical air, the resolve of infiltrators is (conservatively) taken as 50 percent.**

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*(U) These percentages are derived from the historical data of Fig. 6 (p. 25), in which regions 2-8 are considered covered terrain and regions 1, 9, and 10 are relatively open terrain.

**(U) Note that the final results, measured in terms of system efficiency, will be insensitive to the exact value of resolve assumed. In gross terms, the resolve will determine the number of casualties relative to the number deterred. The sum of these, however, will not be affected. We recognize that particular allocations will affect and possibly determine Hanoi's subsequent war effort, but this consideration is beyond the scope of our study.

(C) Based on seven SIP and four area security patrols* per module, each trail of the covered terrain will be monitored once on the average. As assumed in Fig. 15 (p. 103), for a direct monitoring probability, P_{dd} = 0.95, the system detection probability, P_{ds} will also be 0.95. Based on the equal-force ambush results of Table 21 (p. 111), the deterrent probability of threat level 1 ambushes is ~ 1.0; i.e., 15 percent of those detected will become casualties and 85 percent will turn back. Thus, for 99,000 potential infiltrators, 14,100 will become casualties, 79,900 will turn back, and 5,000 will be successful.

(C) For the 11 patrol equivalents in open terrain, providing each with three-300m sensors and assuming that S_i/S_p = 0.5, Fig. 16 (p. 105) indicates the SIP movement path should be from 0.6 to 0.9 km behind the early warning line. If the path selected is 0.6 km (D = 0.6 km) and $\theta_{3\sigma}$ turns out to be 20°, then the detection probability is near-unity; if $\theta_{3\sigma}$ is 30°, P_{ds} = 0.97. For three-200m sensors and a 0.6 km path, the corresponding probabilities for 20° and 30° are 0.99 and 0.91. It is clear from this matrix that the detection probability, P_{ds}, will be of the order of 0.9 or better for open terrain. Note, however, that the patrols will have to break up into units too small to engage their opponents in sustained combat. Given that the infiltrator's resolve is only 15 percent, however, it is plausible that on the average he will sustain one casualty and the balance will turn back. Thus for 1000 potential infiltrators, 135 will become casualties, 765 will turn back, and 100 will be successful.

(C) Overall, for threat-level I against the strong-point system, 14,200 infiltrators could be expected to become casualties, 80,700 will be deterred, and 5,100 will be successful. The system would thus be 94.9 percent effective, on the average, against infiltration. The defender's casualties would be quite low--of the order of 1 to 3 percent (1000 to 3000 per year).

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*(U) Four area security patrols available out of seven deployed around the strong-point.

(C) <u>Case 1A: Same Except The Number Of Jungle Routes Per Module is 22</u>. From the above comments, this would be more than twice the number of identified routes--probably close to an upper bound. From Fig. 15, P_{ds} = 0.875 in the jungle terrain (assuming that the probability of remote detection, P_{dr} is 0.8). Of those detected on directly monitored trails, 7050 probably will become casualties and 39,950 will be deterred. Artillery will be needed to deter those infiltrators remotely detected in jungle terrain. Assuming the first 10 percent (3960) become casualties in the initial claymore ambushes, some 50 rounds of 155mm HE (see Fig. 17, p. 116) will be required to bring the attrition level up to 50 percent (less than 5 min of sustained fire). Thus an additional 17,800 will become casualties and 17,800 will turn back.* All told, including the open terrain infiltration, 29,000 can be expected to become casualties, 58,500 will be deterred, and 12,500 will be successful. The system would then be 87.5 percent effective with the defender's casualties at about half the level as in Case 1.

(U) Figure 20 displays diagramatically the flow logic for Cases 1 and 1A.

(C) <u>Case 2: Threat Level II Against Strong-Point System</u>. This case incorporates the same system activities as the preceding, except that the SIP and the area security patrols (six men) do not attempt to engage the infiltrators who are in <u>40-man units</u>. The patrols alert the reaction forces (QRF), artillery, and air.

(C) The following sequence of events is assumed:

1) The 40-man infiltrator units are not attacked by the 6-man patrols, but QRF and air are alerted.

2) Artillery is immediately initiated (HE in jungle areas and ICM in open areas) with the 6-man patrols acting as forward observers.

3) QRF at least equal to the original size of the infiltrating unit arrive within 15 to 30 min. The QRF occupy positions in the expected path of continuing infiltrators and engage the enemy as necessary.

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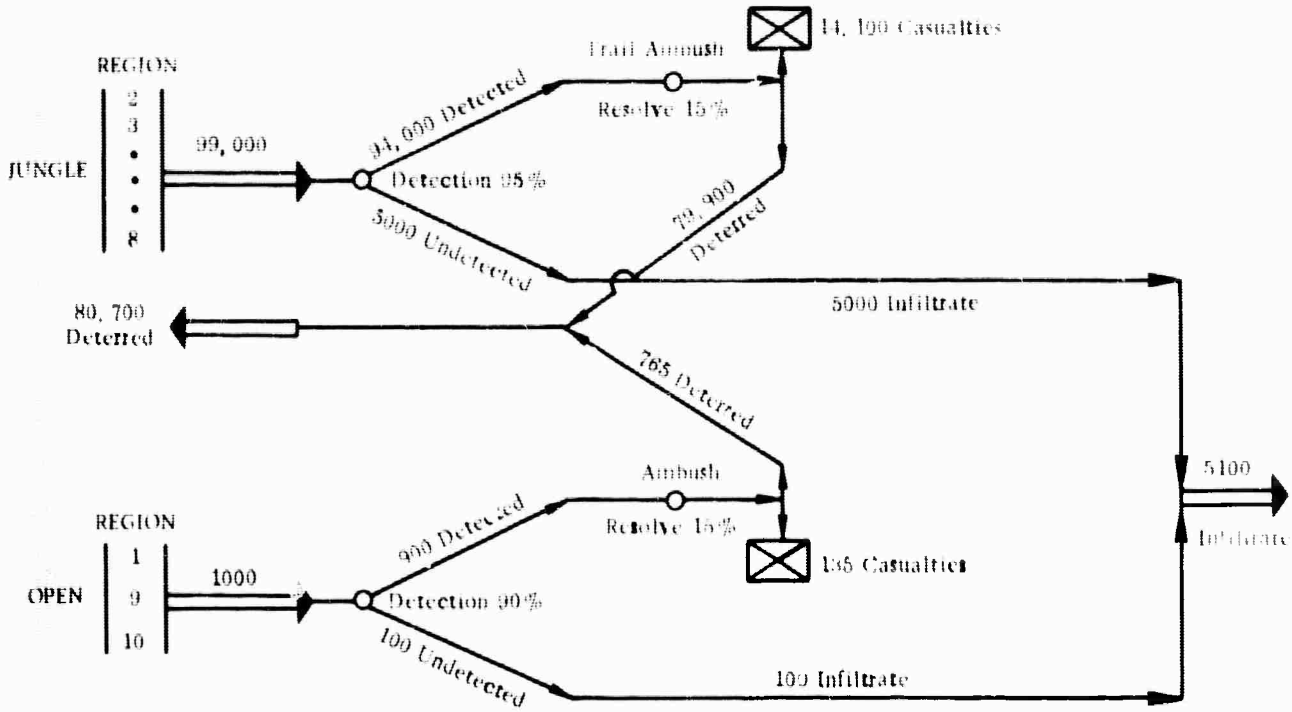
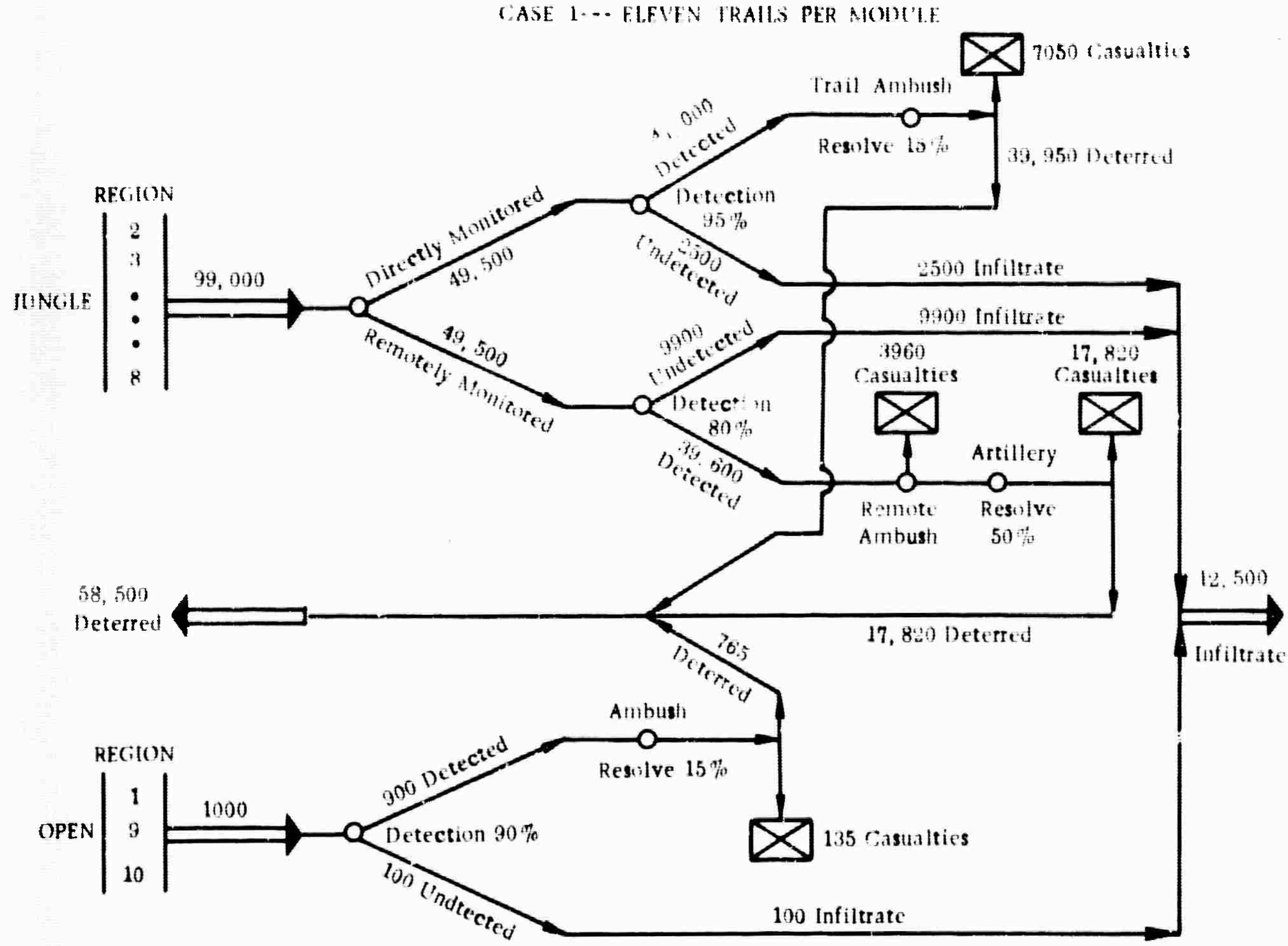
*(U) It is widely believed that a casualty rate at this level is sufficient to terminate the mission and/or cause desertions.[26,27]



CASE 1--- ELEVEN TRAILS PER MODULE



CASE 1A---TWENTY TWO TRAILS PER MODULE

(C) Fig.20 — Infiltrator flow logic for cases 1 and 1A (U)

4) Tactical air in the form of close support for the QRF arrives within 30 to 60 min of the initial detection.

5) The infiltrators turn back if their casualties to the artillery are 50 percent. Of those that continue on and engage the QRF, the resolve is 15 percent.

(C) For the jungled areas with 11 trails per module, a P_{ds} of 0.95 is expected. From Fig. 17, 60 rounds of HE (again, less than 5 min of sustained fire) would be required to produce 50 percent casualties. Five minutes is considered to be insufficient time for the infiltrators to locate the SIP and annihilate them. Thus, on the average, 47,000 casualties and 47,000 turnbacks would occur in jungled areas (compare with 14,100 casualties and 79,900 deterred in Case 1). In open terrain, P_{ds} = 0.9 (as in Case 1). In this case, only 15 rounds of 155mm ICM would be required for 50 percent casualties, producing 450 casualties and 450 turnbacks (compare with 135 casualties and 765 deterred in Case 1). Overall, we would expect 47,450 casualties, 47,450 deterred, and 5100 successful for a system effectiveness of 94.9 percent (the same overall result as Case 1). Since the QRF would rarely be in contact (the bulk of the casualties being artillery inflicted), the defenders' casualties should be lower than for the other cases.

(C) Case 2A: Same Except the Number of Jungle Routes Per Module is 22. As in Case 1A, the system detection probability in the jungle is 0.875. Of those infiltrators detected, 50 percent will be casualties and 50 percent deterred. Overall, 43,750 infiltrator casualties can be expected, 43,750 will be deterred, and (as in Case 1A) 12,500 will be successful; i.e., the system effectiveness will be 87.5 percent effective. Defenders' casualties should again be small. In calling for immediate artillery fire and in alerting the reaction forces that the enemy is penetrating, they avoid engaging the larger force. Because of the higher resolve attributed to infiltrators under an artillery barrage, they sustain more casualties than if ambushed in smaller groups.

(C) Case 3: Threat Level III Against Strong-Point System. For this case, 87 percent (87,000) of the infiltrators attempt to penetrate through jungle terrain and 13 percent (13,000) through open terrain; i.e., Regions 1, 9, and 10 are relatively open terrain. The parameter values and sequence are the same as those used in the preceding case with the following exceptions:

1) Because of the larger threat more artillery is used. The artillery is used after detection of the infiltrators by the patrols, prior to the arrival of the QRF, and subsequently in support of the QRF. Artillery firing continues for as long as 30 to 60 min, and is discontinued upon the arrival of tactical air support.

2) Tactical air supports the QRF beginning 30 to 60 min after the initial detection. The detection probability of the remaining infiltrating group by the tactical air is highly variable depending on the terrain and the success of the QRF in establishing and maintaining contact.

3) The total reaction force consists of the QRF of the strong-point module where the penetration is occurring and the QRF from the adjoining two strong-points; i.e., a 360-man force. This force is deposited at an updated MLIP (based on continuing SIP intelligence), or is split into several forces if the infiltrators have broken up into smaller units. Because the QRF is in place within 15 to 30 min, and since a 400-man infiltrating group could travel from 1 to 2 km at best during this time, the probability of reacquisition is high if the QRF has detailed knowledge of the trail system. However, the QRF may not be able to engage in a "blocking" mode.

4) Resolve for the infiltrating group is taken as 0.15 for troops-in-contact, and 0.50 for artillery or tactical air barrage.

(C) Because of the size of a 400-man infiltrating group, the initial detection probability by SIP and area security patrols is taken as 100 percent (both in wooded and open terrain). We assume that artillery commences immediately and continues, as necessary, for 25 min (about 300 rounds total for 3 tubes). For infiltrating groups in open terrain, as can be determined from Fig. 17 (p. 116), only 25 rounds (of ICM) or 2 min of sustained fire would be required for 50 percent attrition. Thus, of the 13,000 attempting to infiltrate in open areas, some 6500 would become casualties and 6500 would be deterred.

(C) It is unreasonable to expect a 400-man group attempting to infiltrate through jungle areas to absorb a 25-min artillery barrage passively. If the infiltrators remained in place, the 300 rounds of HE deliverable in that time would produce 50 percent casualties. Presumably, to avoid such attrition, the infiltrating force would either retreat or disperse into smaller groups (say, four groups of 100-men; i.e., company size). (We exclude the possibility of the entire force digging in since this would lead to their ultimate destruction albeit with more ordnance expenditure.) The precise course chosen by the enemy would depend on the terrain and his resolve. Conservatively, we assume splitting into smaller forces with a probability of one. However, some portion--say one-fourth--of the force is assumed to remain on the original trail, partially as a decoy and partially as a technique for spreading the defender's force.

(C) Assuming 11 trails per module, and that the diverging infiltrators have the ability to reach any of the remaining 10 trails, the probability of reacquisition by the QRF is 3/10. This situation is quite pessimistic in that it requires the QRF to have no knowledge of trails that will be selected; i.e. updated intelligence by the SIP is ignored. It will, however, permit a lower-bound estimate of system effectiveness.

(C) Therefore, as a lower-bound estimate, (0.75 x 0.3 x 0.95) times (87,000) or 18,600 of the diverging infiltrators will be engaged by the QRF. Of these, an average of 2800 will be casualties, and 15,800 will be deterred; 1000 will successfully infiltrate. Of the 21,800 who remained on the original trails, 10,900 will be artillery casualties, and 10,900 will be deterred and turn back. Of the 65,200 who diverge from the original trails, 45,600 are not engaged by the QRF: an estimated 10 percent of the latter will be attrited by tactical air and subsequent artillery.

(C) Overall (including infiltration through open areas), we expect as a lower bound 24,800 casualties, 33,200 deterred, and 42,000 successful infiltrators--or a 58 percent system effectiveness. This is substantially lower than any of the variations of Cases 1 and 2. Defenders should suffer fewer than 600 casualties.

(C) In practice, because the SIP would be able to provide updated information on trail preferences of the diverging infiltrators, the strong-point system should perform at a higher level (all other things being equal). If (as an upper performance bound) the SIP locate the diverging infiltrators with perfect intelligence, the system effectiveness would be near-perfect with 27,200 infiltrator casualties, and 72,800 deterred. (Since the possibility of stragglers or deserters exists, the precise suballocation is obviously artificial.) Defenders should suffer from 1000 to 2000 casualties.

(C) Both the availability of the large reaction force and the speed with which it can be assembled, moved, and subsequently redistributed are significant factors in the effectiveness of the strong-point system against infiltration units of 400 men. The timing of the QRF response is to some extent under the control of the strong-point troops. By high alert status, training, and coordinated defense planning they can improve the response time. The other condition, i.e., having forces available at the three strong-points, is partly under enemy control. Coordinated attempts by 400-man units to

infiltrate through the area of responsibility of several adjoining strong-points could prevent the availability of reaction forces.*

(C) Under such circumstances, the strong-points would probably require help from the general reserves. Similarly, if the enemy units were larger than 400 men (battalion size)--i.e., regimental size units or larger--the strong-point forces would have to rely on support from the general reserves.

(C) Case 3A: Same As Case 3 Except That Additional QRF From Adjoining Strong-Points Are Not Available. The 120-man QRF of the local strong-point does not split but instead attacks one of the diverging infiltration groups for which the best information is available. The balance of the infiltrators are attacked by artillery and air until contact is lost. Average estimated results are as follows:

Open Areas:

Total Infiltrators: 13,000
Infiltrator Casualties: 6500
Deterred Infiltrators: 6500
Successful Infiltrators: 0
Defender Casualties: 0

Jungle Areas:

Total Infiltrators: 87,000
Original Trail Infiltrators: 21,800
Infiltrator Casualties Original Trail: 10,900
Deterred Infiltrators Original Trail: 10,900
Diverging Infiltrators: 65,200
Infiltrator Casualties to QRF:** 2400
Infiltrators Deterred by QRF: 13,900
Infiltrators Not Engaged by QRF: 48,900

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*(C) These statements apply to the use of forces for reacting to the detection of enemy units attempting to cross the border area and not to enemy attacks on the strong-point installations themselves.

**(U) We assumed that the best updated SIP intelligence reveals the location of one of the diverging infiltrator groups with a net probability of 0.75.

Estimated Infiltrators Attrited by Tactical Air: 4900

Defender Casualties: 500

Total:

Infiltrator Casualties: 24,700

Deterred Infiltrators: 31,300

Successful Infiltrators: 44,000

System Effectiveness: 56 percent

Defender Casualties: 500

(C) Case 3A indicates that reasonably good real-time SIP intelligence can largely substitute for additional QRF from adjoining strong-points. Of course, as indicated above, if additional QRF are available and the SIP provide good intelligence, the system effectiveness will be better, approaching 100 percent as an upper bound.

(C) Case 3B: Same As Case 3 Except 22 Trails Per Module. In this case, there will be, on the average, 24,300 infiltrator casualties, 24,900 deterred, and 50,800 successful. Thus, the system effectiveness for the worst case would be 49.2 percent. Defenders would be expected to suffer less than 300 casualties per year. Note that if the defenders choose tactics and attain intelligence as in Case 3A, system effectiveness reverts to 56 percent since it then would be independent of the number of trails.

(C) Case 4: Threat Level 1 Against Barrier System. In this case, the system will attain close to 100 percent effectiveness. This result is based on a detection probability, P_{ds} of ~ 1.0 for the barrier sensors,* and a deterrent/disablement probability of ~ 1.0. Note that the enemy resolve does not affect the outcome; even if it is 50 percent, the fraction casualties suffered by 6 infiltrators against 20 claymores is 1.0 (as indicated in Fig. 19, p. 120).

(C) Several points are worth noting:

1) The results are quite artificial. In fact, it would be both suicidal and foolhardy for the

*(C) No distinction is made at this point between covered and relatively open terrain since this does not influence barrier operations.

enemy to openly infiltrate 6-man units against the barrier. In such a situation, the barrier is capable of 100 percent deterrence; i.e., in general, 6-man units would not attempt to cross the barrier.

2) The enemy would undoubtedly attempt to develop special means of countering the barrier. These might include tunnels under the barrier; various means or devices to negate, confuse, or saturate the barrier sensors; and techniques to protect infiltrators against barrier ordnance. These developments would require changes in barrier structure and equipment to counter the countermeasures. The form and extent of this game of counter-countermeasures is an open question. However, the enemy would not likely reach the point of superiority enabling 6-man groups to successfully infiltrate on a continuing basis.

(C) Case 5: Threat Type II Against Barrier System. The situation in which 40 men attempt to infiltrate the barrier system can be separated into two interrelated parts; the attempt to cross the barrier, and the attempt to move through the area of responsibility of the relevant strong point. The parameter values for the barrier portion are taken as $P_d = \sim 1.0$, and P_k as determined from Fig. 19 (p.120). For the move through the strong-point area of responsibility, the parameter values are the same as for Case 2.

(C) For the barrier portion of the analysis, we must hypothesize enemy tactics. Barring the development of special counter-barrier techniques or devices as indicated above, one of the ways in which the enemy might attempt to cross the barrier is to sacrifice the number of men needed to open a path through the field of ordnance. Figure 19 shows that if enough men are sacrificed to detonate all items of ordnance in a path through the barrier, 16 men become casualties on a correctly chosen path; i.e., one that exposes each individual to only

one disc of the repeating claymores.* Thus, for this case, 40 percent of the penetrating force would become casualties in clearing the path.

(C) As part of the initial penetration, enemy infiltrators could blow the two fences on the edges of the barrier and the five wire obstacles using bangalore torpedoes or similar devices. This would create a path through the barrier that would then be covered only by artillery. With the use of air-burst 155mm, HE fragmentation (non-ICM) shells with VT fuzing, the artillery would have to be fired coincident with the rush of the remaining troops through the barrier. Airburst is necessary. A large lethal area is required due to the relatively long range (7 to 17.4 km) at which the artillery from the strong-point installation would be firing. Also, extensive use of ground-burst artillery shells would destroy parts of the barrier.

(C) If the enemy attempted to rush one man at a time through the opening with appropriate timing (i.e., after each artillery shell had exploded), he would likely lose a considerable number of troops. Assuming two rounds every 5 sec,** estimating the effective radius of a 155mm shell at about 20m, and allowing (conservatively) 20 secs for the infiltrators to run across the 150m strip (quite an accomplishment considering their equipment load), the probability of disablement is:

$$1-\exp-(2 \cdot 4 \cdot 17.2/150) = 0.60 \ .$$

Thus, of the remaining 60 percent of the penetrating forces, only 40 percent (24 percent of the original) would penetrate the barrier. Since on the average this represents a force of only 9.6 men that

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*(S) This is based on a barrier with five rows of repeating claymores, each row having a stack of four claymore discs, with the P_k of the individual discs averaging 0.8.

**(U) The layout of the strong-points relative to the barrier is such that artillery coverage from adjacent strong-points is available for virtually the entire barrier. The most advantageous place for intruders to penetrate would be midway between the strong-points. Assuming the artillery fire is pre-registered, we have to deal only with the random errors. Then the component of the linear probable error perpendicular to the intrusion path is 18.1m (see Table 23, p. 114). Under these circumstances, the average coverage of the intrusion path with a single 20m-radius weapon is 17.2m.

would be attempting to penetrate the strong-point area, they could be successfully ambushed by the SIP who would be fully alerted to their entry point. Assuming a 95 percent net ambush effectiveness, only 1.2 percent (or 1200) of the total initial infiltrators would be successful. Thus, of the total initial infiltrators, 79,400 would (on the average) be casualties and 19,400 would withdraw. Defender casualties should be less than 600. Again, with the system operating at this level of effectiveness, the infiltrators would quickly realize the futility of attempting to penetrate and in effect be deterred.

(C) Case 6: Threat Level III Against Barrier System. This case also involves penetration of the barrier and infiltration through the strong-point area of responsibility. The barrier detection probability against the 400-man threat is considered ~ 1. The tactics used in penetrating the barrier are the same as in Cases 4 and 5, and exclude development of unique counter-barrier techniques and devices which would result in the counter-countermeasure sequence discussed above.

(C) Each 400-man unit exhausts the barrier ordnance and sends men through at a cost of 16 men for each opening. For each 400-man unit, four such openings are made at a casualty level of 16 percent of the infiltrating force. This represents a smaller loss (16,000 men) than for Case 5 (40,000 men) since the openings are made by 400-man units rather than 40-man units.*

(C) Once the opening is made, the enemy unit probably would not go through in single man rushes. If they did, it would take about 30 min for the remaining men to penetrate. Penetrating in single file would be a poor tactic for the infiltrators; they would be exposed to artillery fire for about 30 min, and could expect to incur heavy losses. On the other hand, if the enemy went through each barrier opening in

*(U) The 100,000-man force is equivalent to 250 units of 400 men each. With four openings per 400 men, a total of 1000 openings are made annually at 16 casualties per opening. By contrast, for the 40-man force, a total of 2500 openings have to be made at 16 casualties per opening or 40,000 total casualties.

a 100-man column, he might also suffer excessive losses to the air-burst artillery.

(C) For an intermediate position, we assume the enemy goes through in groups of 30 men. As in Case 5, it will take the 30-man group upwards of 20 sec to cross the 150m-wide barrier. The artillery fire is now diluted by a factor of four from Case 5; i.e., the attrition probability is 0.204. Therefore, of the remaining 84,000 infiltrators, 17,100 will become casualties while penetrating the barrier. Each 400-man group is now reduced (on the average) to 268 men.

(C) The remaining infiltrators are exposed to the forces of the strong-point installation. As in Case 3, the total QRF is assumed to consist of forces from both local and adjoining strong-points. The total QRF is thus 360 men, and can establish a defensive position by the time the smaller enemy force of 268 men reaches it. (Alternatively, if the infiltrators choose to remain as four separate forces of 67 men, the QRF splits into four groups.) In the resulting engagement, we again assume that the enemy would take at least 15 percent casualties in close combat and start to withdraw. In Case 6, as distinguished from Case 3, the defenders are presumed to know the infiltrator's position with precision because of the barrier sensors, the delay in breeching the barrier, and the added intelligence provided by the SIP.

(C) Under such circumstances, 9500 additional infiltrators could be expected to become casualties, 54,000 would be deterred, and 3300 would be successful. For the system as a whole, there would be (on the average) 42,700 infiltrator casualties; and the effectiveness would be 96.7 percent. Defenders would suffer from 1000 to 2000 casualties.

(C) Case 6A: Same Except The QRF Is Not Augmented By Adjoining Strong-Points. In this case, the QRF of 120 men can handle only half of the infiltrators penetrating the barrier. (Assuming they are split into four groups of 67 each). Of the infiltrators engaged by the QRF, 4800 become casualties, 27,000 withdraw and 1600 successfully infiltrate. Of the infiltrators not engaged by the QRF (33,450), 10 percent (3300) are attrited by tactical air and subsequent artillery;

the balance (30,300) successfully infiltrating. All told, 41,200 infiltrators become casualties (on the average), 27,000 withdraw, and 31,900 are successful infiltrators. The system effectiveness is 68.1 percent, with less than 1000 defender casualties.

SUMMARY

(C) Table 24 summarizes the cases considered above. The main factor influencing these results are:

1) In Case 1, the SIP and the area security patrols are the only means of detection. All infiltrators detected by these patrols are disabled or withdraw. However, a small number of infiltrators are able to penetrate because the patrols are unable to monitor routes with perfect reliability. In Case 1A, there are double the number of jungle trails. Because some of these must be monitored remotely, more than twice as many infiltrators are successful. However, the defenders' casualties are lower and the system is 87.5 percent effective despite the degradation.

2) In Case 2, the patrols detect 95 percent of the infiltrators. Because the infiltrating groups are larger, however, the patrols do not attack them directly but call for artillery fire, air support, and reaction forces. With the patrols acting as forward observers, the artillery is quite effective and causes a large toll of infiltrator casualties (the balance withdraw). In Case 2A, where there are double the number of jungle trails, more than twice as many infiltrators are successful (as in Case 1A); but the system effectiveness is nevertheless 87.5 percent. Defender casualties are low in both cases because infiltrator casualties are largely artillery produced.

(S) Table 24

SUMMARY OF MANNED-SYSTEM EFFECTIVENESS (U)

	Number of Infiltrators					System Effectiveness (Percent)	Defender Casualties
	Threat	Case	Casualties[a]	Withdrew[a]	Successful		
Strong-Point System	1	1	14,200	80,700	5,100	94.9	1000-3000
	1	1A	29,000	58,500	12,500	87.5	500-1500
	2	2	47,450	47,450	5,100	94.9	~0
	2	2A	43,750	43,750	12,500	87.5	~0
	3	3	24,800	33,200	42,000	58.0[b]	<600
	3	3A	24,700	31,300	44,000	56.0	<500
	3	3B	24,300	24,900	50,800	49.2[b]	<300
Strong-Point System With Barrier	1	4	100,000	0	0	100.0	~0
	2	5	79,400	19,400	1,200	98.8	<600
	3	6	42,700	54,000	3,300	96.7	1000-2000
	3	6A	41,200	27,000	31,900	68.1	<1000

[a]The split between casualties and withdrawals is artificial. The total is roughly valid.

[b]Lower-bound estimate.

3) In Case 3, as a lower-bound estimate, the infiltrators split into four groups after being detected by the SIP and coming under artillery fire. QRF from both local and adjoining strong-points are emplaced without knowledge of where the diverging infiltrators choose to continue their penetration. System effectiveness drops to 58 percent despite air and artillery support. In Case 3A, QRF support from adjoining strong-points is not available, and system effectiveness drops to 56 percent (the local QRF concentrates on the diverging group whose path is known with the highest intelligence). In Case 3B, double the number of trails exist in the jungle modules and the defenders revert to Case 3 tactics. Here the system effectiveness drops to 49.2 percent, an overly pessimistic assessment of performance since the defenders can always choose Case 3A tactics independently of the number of trails. In any of these cases, defender casualties are quite low--less than 600 on a yearly basis.

4) In Case 4, the barrier plus strong-point system is completely effective against the light threat.

5) Case 5 demonstrates that the barrier raises the system effectiveness to 99 percent compared to 87.5-94.9 percent for Cases 2 and 2A. Defender casualties, however, are somewhat higher. In general, the benefits of the marginally higher effectiveness must be weighed against the much higher dollar costs involved.

6) In Cases 6 and 6A, the strong-point system with barrier performs considerably better than the corresponding strong-point cases (3 and 3A). Again, however, defender casualties are somewhat higher. In Case 6, where available QRF from adjoining strong-points are assumed, system

effectiveness is 96.7 percent. In Case 6A, where only local QRF are used, system effectiveness drops to 68.1 percent. Although substantially better than the corresponding strong-point case (56 percent), the benefits will again have to be weighed against the much higher dollar costs involved.

(C) For all corresponding cases analyzed (both basic and variations), the strong-point system with a barrier is more effective than without a barrier--although in most cases the increase is marginal. The increased effectiveness stems from the continuous surveillance provided by the barrier. Under the assumed conditions, no enemy units penetrate the barrier undetected. This does not mean that the enemy would not attempt to develop means of reducing the detection capability of the barrier.

(C) In the preceding calculations, estimates of defender casualties were made on the basis of the sample ambush results of Table 21 (p. 111); i.e., 10 to 20 percent of infiltrator casualties. This agrees reasonably well with estimates made in Ref. 29 for all of South Vietnam. For example, in 1967-68, the ratio of enemy to friendly casualties varied between 4:1 and 10:1.

(C) The above analyses are intended to be only <u>gross estimates</u> of the effectiveness of the border security systems since they are based on specific assumptions and use specific parameters. The following sections highlight general (non-quantitative) results and discuss their implications for improved security in South Vietnam.

VI. INTERNAL SECURITY, FORCE IMPLICATIONS, AND COST-EFFECTIVENESS CONSIDERATIONS OF THE VARIOUS BORDER CONTROL SYSTEMS

(C) Previous sections of this report have considered programs for inhibiting infiltration into South Vietnam. These programs have been costed and evaluated under a variety of assumptions regarding infiltration and defender tactics. Implicit in any of these schemes is the notion that a system that can restrict infiltration will produce a significant (and perhaps decisive) effect on the insurgency. Such an assumption warrants analysis, a major goal of this section. Therefore, we propose in what follows to model the input-output manpower relationships for the Vietnamese insurgency by examining in some detail the tradeoffs between border control and internal security. A simplification of techniques developed in Refs. 30 and 31 is used as the analytical tool.

(U) The model used relates infiltration through a "barrier" to residual insurgent force levels over time, the latter taken as a measure of internal security. The force levels are determined as functions of both attrition and replenishment, with replenishment including both local recruitment and infiltration. Differential equations of a type known as "generalized Lanchester equations" are employed; i.e., they deal with both replenishment and attrition for heterogeneous forces. These equations follow the general form:

$$\frac{dN}{dt} = R_N (N, M, t) - K_N (N, M, t)$$

$$\frac{dM}{dt} = R_M (N, M, t) - K_M (N, M, t)$$

where the rate functions represent replenishment (R_N, R_M) and attrition (K_N, K_M)--killed, wounded, captured, and surrendered--with N and M being the force levels of the insurgents and counterinsurgents, respectively. The specific nature of these functions is determined by the type and phase of the conflict involved; in general, they are dependent on N, M, and time, t.

THE REPLENISHMENT FUNCTIONS

(C) For the insurgents, the source of manpower is twofold. Insurgents are drafted or recruited locally from the indigenous population, and also are infiltrated into South Vietnam through a "barrier" in accordance with some predetermined policy. A model for our simplified treatment of the insurgent replenishment rate is:*

$$KN + I_o \left\{ 1 - E_B \left(1 - e^{-\omega t}\right) \right\}$$

where K is a constant reflecting the local recruitment rate, I_o is the nominal infiltration rate, E_B is the nominal (or design) efficiency of the barrier, and ω is a constant reflecting the speed of installing the barrier.

(C) In 1969, VC recruitments were 115 per day, and the average insurgent strength was 250,000;** thus the constant K can be taken as 0.000460. We have already noted the large variation in estimates of the 1969 infiltration rate (see Fig. 4, p. 24); and elsewhere in this report, have assumed a post-hostilities infiltration level of 100,000 per year (274 per day). To bracket all reasonable possibilities, we have treated I_o parametrically examining values of 150, 300, and 450 per day. The nominal barrier efficiency, E_B, is also treated parametrically to more or less reflect the results in Sec. V. Thus, we have assumed E_B = 0.1 to simulate the enhanced surveillance system, 0.5 to simulate the strong-point system against threat level III, and 0.85 to simulate the strong-point system against threat levels I and II, and the barrier system against any of the threats. The parameter ω

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*(C) In Ref. 30, the insurgent recruitment rate is an exponential function of the form $a(1-e^{-bN})$. Thus, the simplified form KN can be considered as the first term of an expansion of the exponential. Ref. 30 also treats the infiltration policy in a more general way and allows for countermeasures to the barrier as a function of insurgent strength.

**(C) Precise estimates are not intended nor would they be warranted for purposes of this treatment. Estimates of the 1969 local recruitment rate were still undergoing official revision at the time of this writing. The rate of 115 per day compares with estimates of just under 100 per day for 1968.(30)

has similarly been examined at two levels. One (a value of 0.00632) implies 90 percent of barrier effectiveness is achieved after 1 year (99 percent after 2 years); a second, (0.0253) implies 90 percent of design effectiveness after 3 months. (For dimensionality, express t in days.)

(C) Given the military superiority of the US/GVN, the counter-insurgency (COIN) force levels are determined more by policy than by the effectiveness of the enemy. Allowing for the planned withdrawal of U.S. forces over the next three years, and the augmentation of GVN forces, we model the COIN strength by:

$$M = 1{,}500{,}000 - 274\,t \quad , \quad 0 \le t \le 1095$$

$$M = 1{,}200{,}000 \quad , \quad t > 1095 \quad .$$

THE ATTRITION FUNCTIONS

(C) In the present treatment, we assume the Square Law model of attrition; i.e.,

$$K_N = \gamma\, M$$

$$K_M = \gamma^1\, N$$

where γ and γ^1 are constants.* This model is based on the notion that the rate of casualties of either side is proportional to the numerical strength of the other side. It is an entirely plausible model for casualty production, particularly as the insurgent force diminishes, if the combatants choose to prosecute the war vigorously.

(C) On the other hand, a variety of alternative attrition models are possible. One that appears particularly relevant is a model that permits the insurgent casualty rate to decrease as their force size decreases. (This could be the result of hiding within the civilian population, or of decreased attention to the war by the government as the internal threat subsides.) To allow for these possibilities, we

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*(C) In Ref. 30, more complicated functions are also assumed including Linear Law models, combination Linear-Square Laws, and corrections for the "end game."

assume two values for γ; the first based on the 1969 kill rate of the VC/NVA (142,000 neglecting captures and desertions), and the second based on half that rate. Converting to a daily basis, we have $\gamma = 2.59 \times 10^{-4}$ and 1.30×10^{-4} casualties per COIN defender per day for the two levels evaluated. Thus, even though we might not be modeling the attrition function with precision, the major long-term implications of variation in the vigor of prosecuting the war should be discernable from our treatment.

(C) Consistent with the techniques of Ref. 30 (in turn based on the observations of Ref. 27), the insurgents are estimated to be twice as efficient per man as the counterinsurgents. The values of γ^1 examined are therefore 5.19×10^{-4} and 2.59×10^{-4}, corresponding to the assumed values of γ. At 1969 rates, the first of these corresponds to 47,400 US/GVN killed and wounded. Considering that U.S. battle deaths were of the order of 100 per week, and that U.S. wounded in battle were four to five times the deaths, the total yearly estimate seems reasonable.*

MODEL SUMMARY

(U) Collecting terms, we have as the model of the internal security situation in South Vietnam:

$$\frac{dN}{dt} = 0.000460N + I_o \left\{ 1-E_B \left(1-e^{-\omega t}\right) \right\} - \gamma M$$

$$M = 1,500,000 - 274\ t \quad , \quad 0 \le t \le 1095$$

$$M = 1,200,000 \quad , \quad t > 1095$$

with the insurgent and counterinsurgent casualties given by

$$\int_o^t \gamma\ Mdt \qquad \text{and} \qquad \int_o^t \gamma^1\ Ndt \quad \text{, respectively.}$$

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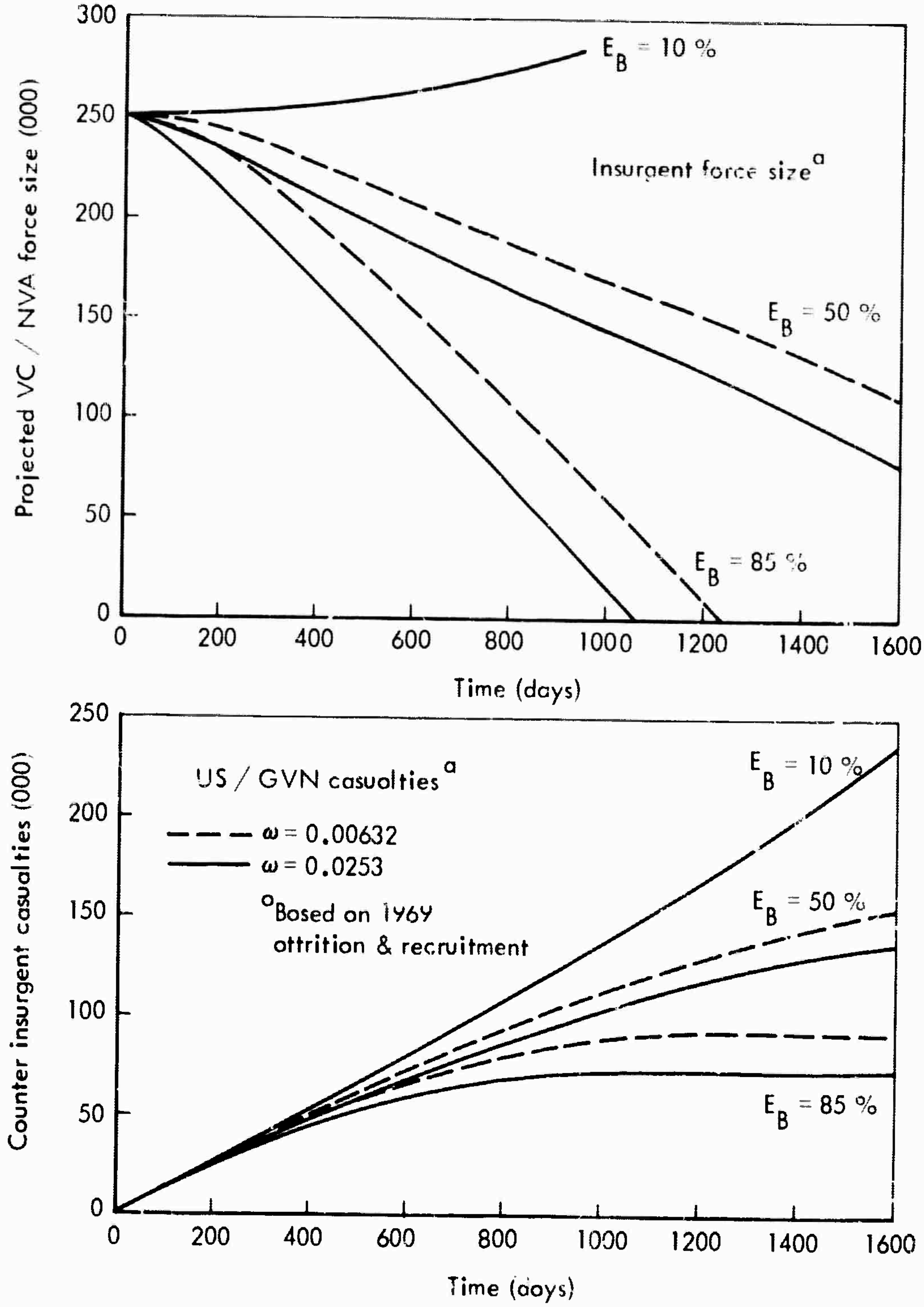
*(C) Consistent statistics for U.S. wounded are difficult to develop since many are returned to battle after initial treatment. Corresponding statistics for RVNAF are even more difficult to develop. As a rough estimate, their KIA were also about 100 per week; however, their ratio of wounded to killed has consistently been lower (2 or 3 to 1).

RESULTS OF INTERNAL SECURITY ANALYSIS

(C) Computer-derived solutions for the internal security model were developed in a five-year time-frame beginning at the commencement of "barrier" installation. Figure 21 shows typical results for the 300-per-day level of infiltration (110,000 per year) and the 1969 attrition rate. Included for each of the barrier installations are the size of the in-country insurgent force, and the defender casualties. Tables 25 and 26 contain a comparison of results for other infiltration levels and other attrition rates.

(S) From Table 25, where 1969 attrition levels are considered, it can be observed that the 85-percent barrier drives the VC/NVA strength to zero within 4.2 years even if they infiltrate at the maximum rate of 450 per day. If infiltration is at the assumed level of this study (just under 300 per day), the insurgents lose in about three years with an 85-percent barrier, and five years with a 50-percent barrier. If the NVA infiltrate at 150 per day (roughly the level for the first half of 1970), even the 10-percent barrier is effective within five years. Note that the main effect of rapid barrier installation is to reduce US/GVN casualties. The reduction is most pronounced for the higher infiltration rates and the more effective barriers, ranging as high as 38,000 over the life of the system. If the Square Law attrition model is correct, however, US/GVN casualties will be high (63,500) even with the most optimistic assumptions of infiltration rate and installation time.

(S) However (as summarized in Table 26), when the attrition rate per man is half that of 1969, none of the barrier systems are very effective in a five-year time-frame. Only the 85-percent system countering infiltration of 150 per day produces a significant effect; close to ten years would be required to drive the VC/NVA force to zero. Ironically, US/GVN casualties are higher after five years than if the war had been prosecuted vigorously. Thus, any hoped-for economies in scaling down the in-country war are completely illusory as far as the casualties are concerned.



(C) Fig.21 —Estimated security implications for nominal infiltration of 300/day (U)

(S) Table 25

INTERNAL SECURITY IMPLICATIONS--1969 ATTRITION (U)

Daily Infil-tration	Nominal Barrier Efficiency	Effect on Insurgent Strength[b]		US/GVN Casualties[a]	
		1-Year Installation	3-Month Installation	1-Year Installation	3-Month Installation
450	0.10	Ineffective	Ineffective	443,000	436,000
450	0.50	Ineffective	Ineffective	270,000	236,000
450	0.85	Zero @ 4.2 yrs[c]	Zero @ 4.2 yrs[c]	124,000	86,400
300	0.10	Ineffective	Ineffective	282,000	278,000
300	0.50	85,100 @ 5 yrs	47,300 @ 5 yrs	167,000	145,000
300	0.85	Zero @ 3.4 yrs[c]	Zero @ 2.9 yrs[c]	92,400	73,500
150	0.10	Zero @ 4.9 yrs	Zero @ 4.9 yrs	122,000	120,000
150	0.50	Zero @ 3.4 yrs	Zero @ 3.3 yrs	86,100	80,000
150	0.85	Zero @ 2.8 yrs	Zero @ 2.5 yrs	70,900	63,500

[a]After 5 years.

[b]Ineffective implies insurgent strength increases or remains same.

[c]The differences between these cases are first discernable in the third significant figure.

(S) Table 26

INTERNAL SECURITY IMPLICATIONS--50% 1969 ATTRITION (U)

Daily Infil-tration	Nominal Barrier Efficiency	Effect on Insurgent Strength		US/GVN Casulaties[a]	
		1-Year Installation	3-Month Installation	1-Year Installation	3-Month Installation
450	0.85	Ineffective	Ineffective	162,000	133,000
300	0.85	Ineffective	Ineffective	136,000	117,000
150	0.10	Ineffective	Ineffective	163,000	162,000
150	0.50	Ineffective	Ineffective	135,000	129,000
150	0.85	200,000 @ 5 yrs	168,000 @ 5 yrs	109,000	99,800

[a]After 5 years.

(S) To summarize the long-term security implications of border control systems for South Vietnam:

- Both the strong-point system and the strong-point plus barrier system will "defeat" the VC/NVA in a five-year time-frame for any of the threats assumed in this study (100,000 per year), provided the war is prosecuted at a level commensurate with 1969 activity. The addition of the barrier system significantly reduces countrywide US/GVN casualties, although (as noted above) it also considerably increases the cost.
- If the NVA maintain their infiltration rate at the first-half 1970 level, any of the barrier systems (including the enhanced surveillance system) in conjunction with a vigorous war effort will destroy the enemy force within five years.
- Rapid installation of any of the border control systems is mainly effective in reducing US/GVN casualties.
- If the in-country war is not prosecuted vigorously in conjunction with the border control installations, none of the systems considered are effective in reducing the enemy force. Lack of a vigorous war effort will also increase US/GVN casualties in a five-year time-frame.

CURRENT AND FUTURE FORCE IMPLICATIONS

(S) Implementing an improved border security program such as one involving 63-90 strong-points, plus enhanced border surveillance techniques, will have a number of important force implications for South Vietnam. Its success will depend upon, and influence, the progress of the VIM program.

(C) Some of the more obvious implications have already been stated for the enhanced surveillance part of the program (see Sec. IV). They included the training of South Vietnamese in the use, maintenance, and management of sensors, radars, and data-handling equipment.

We assume that over the next several years the South Vietnamese can develop the skills necessary for this part of the program.

(S) To bring into perspective the quantitative implications of an improved border security system for the 1973 VIM program, it is instructive to first compare the projected 1973 VIM with December 1969 in-country force levels. A gross comparison of these forces is made in Table 27. (Details are given in the Appendix.) Substantial reductions of force strength are clearly projected in all categories except paramilitary forces, for which modest to substantial increases are expected.*

(S) Table 27

COMPARISON OF DECEMBER 1969 AND ESTIMATED 1973 FORCES (U)

Type	U.S. and RVN-Dec 1969	Estimated RVN-1973	Approximate Change
Force Level (x 1000)	1643	1212	-25%
Maneuver Battalions	282	187	-33%
Artillery Battalions	115	52	-55%
RF/PF Personnel[a] (x 1000)	485	545	+12%
Attack Capable Aircraft/Helicopters	1262[b]	394	-70%

[a]Not included are other paramilitary forces including CIDG, Revolutionary Development (RD) Cadre, National Police, and People's Self-Defense Forces (PSDF). The latter force, although poorly armed and trained, is scheduled to grow to more than one million by 1973.

[b]Total includes an estimated 570 U.S. armed helicopters, and excludes a much smaller number of VNAF armed helicopters.

(S) We can now compare the force levels that would be involved in a manned border security program with current and projected forces.

*(U) Not included in Table 27 is the increase in combat capability of RVNAF through improvements in leadership, fire power, and force mobility. Although this is a critical objective of the VIM program, the degree of improvement is difficult to assess.

Table 28 displays December 1969 force levels and our estimates for the threat level III border security program (exclusive of any forces currently involved in border security operations).

(S) Table 28

DECEMBER 1969 FORCE LEVELS AND ESTIMATED UTILIZATION IN BORDER SECURITY FOR THREAT LEVEL III (U)

	Dec. 1969	Estimated Border Security	Percent
INFANTRY BATTALIONS			
U.S.	97		
RVN	185		
Total	282[c]	90	32%
ARTILLERY BATTALIONS			
U.S.	70		
RVN	45		
Total	115	15	13%
ATTACK CAPABLE AIRCRAFT			
U.S.	1096		
RVN	166		
Total	1262	48[a]	4%
HELICOPTERS			
U.S.	2000+		
RVN	84		
Total	2084	459[b]	22%

[a]Estimate based on two squadrons in support of strong-points.

[b]Based on 6 helicopters in 63 strong-points, and an average of 3 in the 27 strong-points of the Delta. (Naval craft partially substitute for helicopters in the Delta strong-points.)

(S) From Table 28 it is evident that the manned border security systems, as configured in this study, would require about 32 percent of all the RVN and U.S. infantry battalions in the country at the

beginning of 1970, and lesser percentages of other forces. Certain specialized forces not included in the totals are:

1) F-4 aircraft used for emplacing sensors (from Thailand).
2) Relay aircraft (EC-121R and YQU-22A).
3) B-52 aircraft.

(S) A comparison of the manned border security system requirements with the estimated 1973 VIM program is shown in Table 29. It indicates that a strong-point border security system of the type described would require a significant portion of the projected RVN forces (a larger fraction than of current forces since the 1973 VIM force will be smaller). In addition, no F-4 aircraft for sensor emplacement, relay aircraft, or B-52 aircraft are part of the VIM program. As indicated in Sec. IV, the currently constituted VIM program would have to depend on the U.S. providing these aircraft or on some substitute means of accomplishing their missions. The relay aircraft, for which there is no replacement in the current VIM, appear to be critical in this respect.

(S) Table 29

ESTIMATED 1973 VIM FORCE LEVEL AND BORDER SECURITY REQUIREMENTS (U)

	1973 VIM	Threat Level I & II Border Security	Threat Level III Border Security
Infantry Battalions	189	63 (33%)	90 (48%)
Artillery Battalions	52	10.5 (20%)	15 (29%)
Attack Capable Aircraft	394	34 (8.6%)	48 (12%)
Helicopters	500+	321 (64%)	459 (92%)

(S) Based on data presented above, we can estimate South Vietnamese force levels available for all missions other than border security in 1973, and compare them with the current force levels. These "residual" forces (i.e., the total estimated 1973 force levels less those involved in border security) would be the regular forces available for internal security, pacification, and all other missions

in addition to constituting the general reserves in the event of a major North Vietnamese attack. Table 30 shows the percent change in force levels under these conditions.

(S) Table 30

DECEMBER 1969 AND ESTIMATED 1973 RESIDUAL FORCE LEVELS (U)

	Dec. 1969[b] Force Level	Estimated Residual 1973 Force Level[a]	
		Threat Levels I & II	Threat Level III
Infantry Battalions	282	126 (-55%)	99 (-65%)
Artillery Battalions	115	41.5 (-64%)	37 (-68%)
Attack Capable Aircraft	1262	360 (-71%)	346 (-73%)
Helicopters	20[illegible] +	179 (-92%)	41 (-98%)

[a]1973 VIM less border security requirements.

[b]Excludes December 1969 forces engaged in border security, which are difficult to estimate and, in any event, small.

(S) Obviously, the insurgent threat level will have to diminish significantly by 1973 if about one-third of the December 1969 force levels are to maintain internal security in South Vietnam. (The likelihood of such changes are considered above.) The most serious situations occur for threat level III (more or less the situation existing in December 1969). In terms of border operations, the severe reduction in helicopters is critical since they are essential in meeting the infiltration threat at this level.*

(S) The preceding estimates have considered only regular RVN forces (ARVN) Other forces, particularly the Regional Forces (RF), are scheduled to take over part of the ARVN's responsibilities for internal security. Conversely, they might be used in the manned border security systems. Using more RF units in this role has a number of advantages (discussed in Sec. VII). Their use, however, would not

*(C) Note, however, that deficiencies in attack capable aircraft and helicopters for threat levels I and II are more apparent than real. Very few were required in the effectiveness models to achieve high levels of impermeability.

reduce the need for artillery, attack capable aircraft, or helicopters in border security operations (particularly for threat level III); and such supporting forces have in the past been available only to the ARVN and not to the RF.

(S) Since internal security will undoubtedly remain the primary mission of RVN forces, a substantial allocation of ARVN (along with their supporting forces) to border security may not be possible. If so, one alternative for the improved border security program would be to reduce the amount of artillery and the number of helicopters used in the strong-point system--which would reduce system effectiveness in responding to sensor activations and in moving reaction forces. This reduction in the amount of modern equipment available to border security forces could force them to resort to more intensive use of South Vietnamese personnel; or, in the extreme, could force abandonment of parts of the border security system in order to concentrate on existing higher threat areas. This alternative could, in a sense, recreate the situation that existed in December 1969, when internal security requirements and enemy presence in some border areas prevented a large commitment of forces.

(S) A second alternative would be to augment the VIM program. The program would have to be expanded to include not only the equipment and weapons needed for maintaining internal security as presently programmed, but also that needed for maintaining the border security systems. Based on a border security system of 63-90 strong-points plus an enhanced border surveillance capability, we can estimate the types of equipment needed. It should first be pointed out, however, that throughout this study border security is treated as essentially a separate activity from other military activities in South Vietnam. This is done for convenience in presentation; it is recognized that the separation is artificial. Specifically, some forces and some equipment (air, artillery, helicopters, etc.) contribute to both activities. For example, artillery bases in III and IV CTZ provide support of both border security and internal security operations.

Similarily, aircraft used in support of forces in the border areas are also used in the support of internal security operations.*

(S) Assuming that a) a border security program of strong-points and enhanced surveillance capability were implemented in the next several years in South Vietnam, <u>and</u> b) that the South Vietnamese were to take over al' operations by 1973, we list below estimates of the major equipment needed to maintain the program without recourse to diversion of currently programmed VIM assets:

1) <u>Vehicles for air emplacement of sensors</u>. Aircraft like the currently used F-4 or a substitute (e.g., the A-1 or A-37) would be appropriate. Helicopters for air emplacement or for air-lifting of ground emplacement teams are feasible for this mission, but they would not be adequate in high-threat areas. Six aircraft and six helicopters (as described in Sec. IV) are needed.**

2) <u>Aircraft for air relay of sensor data</u>. The YQU-22A is the prime candidate. Twenty-four aircraft are needed.

3) <u>Helicopters</u> for the strong-point system. These vehicles are used for airlifting patrols, moving strike forces, and resupplying the strong-points. They could also emplace sensors where feasible, and provide fire support if armed. In the system configuration described, 459 helicopters are assigned to the strong-points for threat level III, and 321 for threat levels I and II.

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*(U) Note that when the systems were costed, we assumed that half the helicopters and all of the tactical aircraft could be made available from the 1973 VIM. Also, for threat levels I and II, half of the required artillery was assumed available from the 1973 VIM.

**(S) This does not include those involved in Laotian operations, assumed to remain U.S. operations for as long as they are continued.

4) Artillery for the strong-points. Two-hundred-seventy tubes (15 battalions), preferably 155mm because of the longer range and higher lethality, would be needed for threat level III; 189 tubes for threat levels I and II.

5) Attack capable aircraft. An estimated 48 aircraft are needed fc: air attacks against infiltrators for threat level III and 34 for threat levels I and II. These could consist of attack aircraft (A-1, A-37) similar to those in VNAF, and fixed-wing gunships.

(S) Table 31 displays the equipment totals. We again emphasize that these assets are incremental to those estimated for the 1973 VIM program, assuming that:

a) A manned border security program of the type described (63-90 strong-points plus enhanced border surveillance) is implemented.

b) Internal security conditions do not permit the use of the assets already programmed for the 1973 VIM program.

(S) Table 31

ADDITIONAL EQUIPMENT NEEDED FOR ESTIMATED 1973 VIM PROGRAM (U)

Type	Candidates	Threat Level	
		I & II	III
1. Vehicles for air emplacement of sensors	F-4s, helicopters, or substitutes	12[a]	12[a]
2. Air relay aircraft	YQU-22A	24	24
3. Helicopters for strong-points	UH-1 or similar	321[b,c]	459[c]
4. Artillery	155mm	189[c]	270
5. Attack aircraft	A-1, A-37, gunships	34[a,b]	48[a]

[a]Not included in cost estimates.

[b]On the average, these assets would be held in reserve. They would probably be needed only in the worst infiltration areas.

[c]Half included in cost estimates.

c) Assets included in current RVN border security operations are small compared to the requirements and can be neglected.

The latter two assumptions are probably overly pessimistic.

(S) In addition to major equipment, the program would also have to include sensors and radars, ground relay, data processing, communications, and ammunition associated with the border security system.

(U) In the following discussion, factors relating to effectiveness, cost, and sufficiency will be integrated so that a choice of the most cost-effective system can be made.

COST-EFFECTIVENESS CONSIDERATIONS

(C) In general, the effectiveness calculations made in Sec. V highlight three points:

1) As the detection coverage (surveillance) of potential infiltration routes increases, the performance of the system improves. In all corresponding cases, the continuous coverage provided by the barrier offers a greater opportunity for attacking targets than is provided by the strong-point system without a barrier.

2) The use of ground troops in the border area for quick reaction to penetrations, and for directing artillery fire and air strikes, is an important factor in the effectiveness of counterinfiltration systems.

3) Against large threats of 400-man, battalion-sized penetrations (threat level III), the particular system configurations described are successful only if: 1) they respond in a coordinated and timely manner, i.e., reaction forces from several system modules are assembled and deployed to stop the infiltrators; or 2) the SIP plus the sensors maintain continuous intelligence on the

location of one or more of the major groups into which the infiltrators disperse.

(C) These three points, which are generally applicable to any substantial attempt to improve security along the land border of South Vietnam, stress:

o The importance of surveillance of as much of the border area as possible. Not only must areas where infiltration is current be monitored, but also those to which the enemy might shift if opposed.

o The importance of manned systems. If relatively high effectiveness is to be achieved in border security operations, ground forces are necessary to provide intelligence, to react to enemy penetrations, to provide and control artillery fire, and to direct air strikes.

o The importance of coordination, particularly against large enemy units. If the response to such a threat is to be effective, forces must be able to shift from one area to another under the control of some higher echelon, such as the Corps Tactical Zone headquarters. The alternative would be to so heavily man the border along its entire length that any level of infiltration could be opposed locally and independently. This would require large forces deployed in depth at every point. The mobility provided by helicopters (or boats and vehicles in some areas) in the strong-point system provides the means by which reaction forces can be shifted to support one another if the situation requires.

(S) These three considerations apply to any defense line in South Vietnam, including those not along the border. Other defense lines, i.e., lines providing some degree of continuous protection to

the population in the rear, could be established in South Vietnam. Figure 22 shows two of the many possible "defense lines" of this type.

(S) One line runs along Route 14 through the Highlands and then to the border in the III CTZ area. The other is not a line at all, but a disconnected series of areas constituting a population or demographic frontier. It includes most of the areas of South Vietnam with a population density greater than 1000 people per square mile.

(S) Either of these lines (and others) could be main defense perimeters against infiltration using frequent patrols or sweeps to prevent the enemy from gaining increased control of the interior. The many arguments, pro and con, for the utility or feasibility of substituting these lines for the political border are not considered in this study. One point, however, is worth noting. Whatever advantages or disadvantages either of these lines might have for border security, it cannot be argued that they represent a shorter line to defend. Both are of approximately the same length (1400 km) as a line paralleling the political border. It is also likely that any defense along these lines would use either strong-points or strong-points with a barrier as illustrated in this study.

(S) Our in-depth analysis, however, concerns only the defense of the border area. The analysis underscores the three points indicated above and--under the specific assumptions made--indicates that the strong-point system with a barrier outperforms the strong-point system without a barrier in all cases, primarily because it provides continuous surveillance of the border area. In this sense, the strong-point system with a barrier would be the preferred border security system for South Vietnam in terms of reducing the amount of infiltration.

(S) However, a number of other factors have to be taken into account. First, the barrier involves a substantial construction

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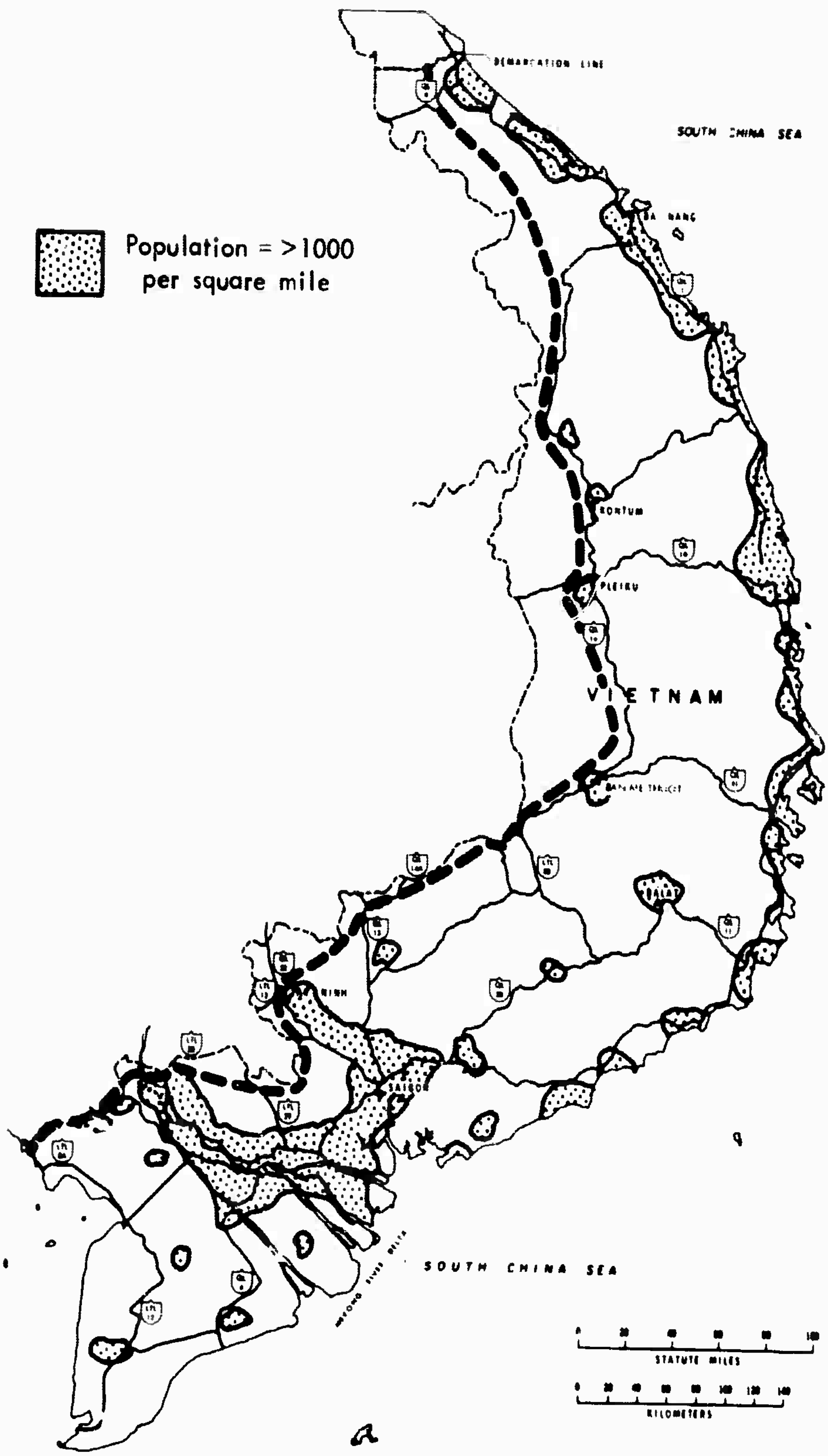
* (C) An additional possibility of particular relevance since the Spring 1970 incursions into Cambodia is a defense line along Route 9 extending from Dong Ha in SVN to Savannakhet in Laos. Although attractive from a military point of view and from the standpoint of bolstering a non-Communist government in Cambodia, it is fraught with political difficulties--particularly on the domestic U.S. scene.



(S) Fig.22 -- Possible "Interior" defense lines (U)

effort. The dollar cost of the construction is a major part of the total system cost, and cost considerations are of major importance to the feasibility of installing the barrier. Furthermore (as indicated in Sec. V), a negative attitude exists toward the construction of fixed barriers. Many people remember the Maginot line, which, after great expense, failed to stop the enemy.* This attitude tends to underestimate the value of a properly designed and located barrier as a surveillance and warning system, and as a means of delaying the enemy until appropriate reaction forces can arrive.

(S) A more crucial factor in South Vietnam is that the barrier portion of the system would probably have to be constructed in the face of enemy opposition. Both U.S. and RVN forces have had experience in establishing artillery fire support and logistic bases in border areas. It is feasible, at least in most cases, to set-up strong-points. But where large-scale land clearing or re-routing of canals and construction of berms is required, the construction forces can be exposed to enemy mortar, rocket, and artillery fire, and subjected to infantry assaults.

(S) Even if attempts were made to install barriers in areas where the enemy's activity is low, he could shift forces and attack the construction sites. This possibility could lead to committing combat troops to protect the construction units; which, in turn, would required increased logistic support. Historically, considerations of this type led to the abandonment of attempts to install a barrier along the eastern end of the DMZ in 1967-68.

(S) Thus, the true cost of installing the barrier portion of the strong-point system would have to account for the commitment of combat forces <u>and</u> support forces, as well as the casualties these forces would incur during the construction period. This cost in lives in addition to dollars would be a major consideration in undertaking construction of the barrier.

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*(U) In fact, the Maginot line was never intended to "stop" the enemy. It was intended to delay the Germans until allied forces could be mobilized. Moreover, in 1940, it was largely outflanked rather than penetrated.

(S) As indicated in Table 24 (p. 137), the strong-point system superimposed on the enhanced surveillance system provides a very effective barrier against threat levels I and II (better than 85 percent). Against threat level III, this combination produces effectiveness levels of better (possibly substantially better) than 55 percent. Under the worst circumstances, the addition of the barrier raises this to only 70 percent. Moreover, this level could only be accomplished by increasing dollar expenditures more than 47 percent (see Table 17, p. 79, and Table 20, p. 99). Therefore, although a strong-point system with a barrier would present the most effective border security system because of its continuous-surveillance and immediate-interdiction capabilities, it would not be a cost-effective alternative. Since (as shown in Table 25, p. 146) a combination of either strong-points plus enhanced surveillance or strong-points plus barrier plus enhanced surveillance will reduce the enemy force to an acceptable level, we can eliminate the barrier installation as a viable choice.

(C) The preferred option is the combination of the enhanced surveillance system and the strong-point system. This combination of improved border surveillance plus ground forces supported by artillery (and air) could provide a partial substitute for the complete surveillance of the barrier. The enhanced surveillance system would permit more effective use of the strong-point assets in several ways:

1) By remote monitoring of routes regarded as unlikely infiltration choices. This would reduce the number of routes that the patrols would have to cover routinely.
2) By providing early-warning intelligence of enemy movement so that patrols could be assigned selectively to those routes where infiltration units are small.
3) By alerting the strong-point to the infiltration of large enemy units so that air, artillery, and reaction forces could be brought to bear as required.

(C) The combined system would also enhance effectiveness in two other ways. Strong-points along the border would provide the necessary ground forces and artillery, and the command and control for more effective use of artillery and air strikes. Similarly, the enhanced surveillance system could provide the early-warning intelligence necessary to alert the strong-points to the size and location of the enemy unit, and increase the time available to assemble and dispatch reaction forces.

(C) A number of other options might warrant consideration. One would be enhanced surveillance along certain critical infiltration routes that have proved particularly troublesome in the past. The A Shau Valley controlling the approaches to Hue and Danang is a prime example. In previous operations, the maintenance of artillery strong-points in this area has proved infeasible in terms of the requirement to keep US/RVN casualties at acceptable levels. The substitution of a dedicated tactical air squadron monitoring densely emplanted ground sensors might be an acceptable alternative. Rough calculations indicate that $30 million per year would be required to pay for this option (which could be carried out completely by the VNAF in conjunction with ARVN).

(C) Another possibility is enhanced border surveillance in III-IV CTZ and strong-points plus enhanced surveillance in I and II CTZ. This combination appears to be an attractive alternative for threat levels I and II, lowering the cost of the combined system described above, and at the same time providing for the contingency that infiltration in III-IV CTZ may increase again at some future date. In the latter event, the strong-points could be extended to the rest of the border.

(S) To summarize, of the systems considered in this study, a manned border security line of 63-90 strong-points together with an enhanced surveillance system appears to be sufficient and the most cost-effective. If installed over the next few years, it would use a relatively small portion of the combined U.S. and RVN force levels. However, as U.S. troops (and air) assets are withdrawn under the VIM program, and if the necessary assets were committed to border security,

they would constitute a major part of the RVN forces. If the internal security situation did not permit such an allocation of assets, the requirements of the manned border security systems would have to be added to the VIM program by 1973.

VII. CULTURAL AND POLITICAL IMPLICATIONS OF A MANNED BORDER SECURITY SYSTEM

(U) This section discusses some of the intangible implications of implementing an improved border security program of the type described in this report. The main topics concern system manning particularly as it requires redeployment of RVN forces. For many of the implications, a quantitative analysis is difficult. In some cases, rough estimates are made to indicate the magnitudes involved.

(C) Two major alternatives in the manning of the border security system are:

1) The use of regular forces, i.e., the Army of the Republic of Vietnam (ARVN) only;
2) The use of a mix of ARVN and other RVN forces.

(C) We do not consider U.S. manning of the border security system on a long-term basis, although U.S. forces might participate in training the RVNAF, in installing the system, and in the early period of manning. Nor do we give credence to the possibility of manning border outposts with only paramilitary forces (e.g., RF). Such forces would appear to lack the organizational and leadership skills to manage a border control program on a country-wide basis even if provided with the necessary heavy equipment. However, the RF might feasibly manage selected portions of the border.

ARVN MANNING OF THE BORDER SECURITY SYSTEM

(S) As of early 1970, ARVN consisted of about 390,000 men--comprising 185 infantry battalions and 45 artillery battalions--engaged in a variety of missions including the protection of key areas and main lines-of-communication, pacification, and some border security operations.* As the VIM program progresses, it is assumed that ARVN

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*(U) In addition, the ARVN commenced a series of sweep and clear operations into Cambodia in the Spring of 1970, partially to help support the Lon Nol government, partially to clean out VC/NVA strongholds in the border areas, and partially to preclude VC/NVA resupply from Sikanoukville.

will take over more and more U.S. ground force areas and operations, and that more RF will be used for internal security.

(S) For the border security system of strong-points (excluding current force dispositions), 63 to 90 battalions would be needed, or about one-third to one-half of the ARVN. Many of these battalions would have to be redeployed from their present locations to the border area. Several considerations may influence the success or rate of ARVN redeployment.

(S) ARVN Attitudes Toward Redeployment. Because of the nature of the conflict in South Vietnam, ARVN forces have been stationed in populated areas of major political and economic significance and along the most important interior routes of communication. The location of corps and, in many instances, division headquarters and of the bases of large units have generally remained the same over many years. In most instances, these have been well removed from the border. Aside from military considerations, these troop dispositions appear to be influenced to a significant degree by political and economic interests of the South Vietnamese military. ARVN as a whole (and its corps and division commanders) wields a great deal of national and local political power and influence in South Vietnam. Presumably, a relationship exists between the political role played by ARVN and its commanders and the number and locations of the troops under their respective control. The central government of South Vietnam also appears to have an interest in troop deployments, especially those close to Saigon, in order to insure support for itself or to neutralize the possibility of a military coup by various elements of these forces.

(S) Based on past behavior, one may conjecture that some of the same factors will operate in the future. ARVN and its field commanders may be sensitive to substantial reductions in their political power that would result from redeployment of major ARVN elements from present locations to the border, and the dispersal of troops in fixed bases along the border areas. The NVA threat, in-country security considerations, political currents, conflicts with ethnic or religious minorities, personal political ambitions, or the central government's requirements for support and protection may tend to influence

the desire of the commanders to keep the largest possible number of troops under their control and in locations removed from the border areas. The withdrawal of U.S. troops may serve to reinforce possible arguments by ARVN commanders for the need to maintain large forces to protect high-value and populated areas and valuable bases relinquished by the U.S. Although we cannot predict how the political role and power of ARVN and its commanders may change in the future, conceivably, in relation to border security, they may insist not only on maintaining large mobile units in areas of high value, but also on:

1) Maintaining many division headquarters and main ARVN units in the most advantageous political locations;
2) Retaining the right for temporary recall of elements of the border security forces, should they believe it necessary;
3) Reserving the right to divert resources and supplies from border security to other missions;
4) Reserving the right to commit the necessary forces to support units deployed along the border. This caveat could prevent creation of dedicated reaction forces as a backup for the border security units. Any uncertainties concerning support from reaction forces in situations of heavy enemy pressure, or about their ability to exploit intelligence and delaying efforts of the border forces, would likely be detrimental to the morale and effectiveness of border security units.

(S) For these reasons, a major factor in the successful implementation of an improved border security program depends on obtaining the cooperation of both senior ARVN officials and the central government. Steps in this direction are early and continuing participation in discussions and planning of border security programs, recognition of the particular interests of senior ARVN officials, and encouragement of ARVN commanders to tailor the planning and implementation of the program in ways that will be acceptable to them after U.S. withdrawal.

(S) Ultimately, however, the extent to which ARVN commanders would be willing to deploy a sizable portion of their forces to the border area will probably be determined by their weighing the value and utility of improved border security against their views of the future (including NVA reactions) and the effect on their local political and military power. Progress in the VIM program and in internal security would help to encourage ARVN support of troop redeployment.

(C) ARVN Attitude Toward Service In Remote Areas. Many South Vietnamese dislike serving in remote areas, especially the mountain and jungle regions. Protracted stationing of South Vietnamese personnel in remote areas may cause morale problems and degrade the effectiveness of the border security system. Incentives may be necessary, therefore, for some personnel, particularly those stationed in the western portion of the Central Highlands. These incentives could take a variety of forms: extra pay,* shorter tours of duty, prolonged leaves with the opportunity to take families to other areas of South Vietnam, more rapid advancement, etc.

(C) The precise nature of the incentive structure, if required, could be determined by the extent to which the dislike of remote area service shows up in high desertion rates, poor system performance, or other ways. It might be worthwhile to anticipate this difficulty by a study of ARVN attitudes toward border-area service and the types of border conditions, incentives, etc. that would ameliorate the dislike. Such a survey could result in a program of preventive measures.

(U) ARVN Dependents. A widespread Vietnamese practice is for families to follow military members and settle near bases or stations. As a rule, the South Vietnamese government makes no special provision for such dependents, who frequently live in very poor conditions with few if any educational and medical services. For the

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*(U) Pay incentives, however, for personnel serving in remote areas would exacerbate an already difficult inflationary situation in the RVNAF. As pointed out in Ref. 32, RVNAF personnel serving in and near the major cities are most in need of pay boosts. It might therefore be necessary to provide across-the-board increases to RVNAF, supplemented by special incentives to personnel serving in remote areas.

remote areas, this practice could produce an influx of dependents into the strong-point area or into nearby hamlets. Based on a ratio of 2 or 3 to 1 for ARVN soldiers with dependents, each strong-point area might have 2000 to 3000 South Vietnamese civilians located nearby or attempting to move into the strong-point.

(U) To meet this situation, advanced planning might include housing for selected dependents, medical and educational services, etc. as part of the incentive program for border duty. In addition, land grants might be made in border areas (although this might exacerbate the already strained relations between Montagnard and Vietnamese inhabitants of some regions). Such measures could be the basis for a resettlement program in some of the remote areas of I and II CTZ, which would open them to further development. As noted below, however, the effectiveness of such a program would be influenced by the reactions of local inhabitants.

(U) ARVN Relations With Local Inhabitants Of Remote Areas. The border regions of South Vietnam are predominantly inhabited by ethnic and religious minority groups (Montagnard, Cao Dai, and Hoa Hao) whose relations with the Saigon government have on occasion been strained. Government attempts during the Diem regime to settle large numbers of South Vietnamese in the Highlands and to place some of the Montagnard tribes on reservations failed. The Hoa Hao, on the other hand, have been generally successful in keeping government administrators out of their areas and in insisting on their ability to administer and, to a large extent, defend themselves.

(U) The two-thirds of the border that is the least developed and most remote, and that also includes the areas of heaviest North Vietnamese infiltration, is inhabited by Montagnard tribes. These tribes have had varying degrees of contact with the Saigon government, ranging from partial control to overt hostility or no contact at all. For example, the Katu, who normally inhabit sections of Quang Nam and Quang Tri provinces bordering Laos, have had little or no contact with Saigon and appear to have come under considerable enemy influence.[10]

(U) Elements of other tribes have been periodically in armed revolt against the government. The protracted resistance to the Saigon

government led by FULRO* since 1964 appears to have become more relaxed following the agreement concluded with Saigon in early 1969. But despite improved relations between the Montagnards and Saigon, and greater willingness on the part of the latter to satisfy some Montagnard demands (e.g., land titles, more Montagnards in administrative positions in the Highlands, the formation of some self-officered all-Montagnard RF units), many sensitive issues and uncertainties inhibit implementation of the settlement. Furthermore, not all tribes are under FULRO control or participated in the settlement. Indeed, as noted, elements of some tribes along the border are under VC influence; and undoubtedly the attitude of the Montagnards will also be strongly influenced by developments in the security situation in the Highlands. The long history of conflict between the Vietnamese and the Montagnards has perpetuated a general tendency among Vietnamese to regard the Montagnards as savages and inferiors; and the latter fear and mistrust the Vietnamese, whom they see as trying to deprive them of their land, cultural identity, and independence. Although effective border security may require Saigon to have the cooperation and loyalty of the Montagnards and other ethnic and religious minority groups residing along the border, achieving this condition may prove a difficult and lengthy process.

(U) Although elements of the minorities may welcome ARVN efforts to improve their security, others may view the deployment and permanent stationing of large numbers of ARVN troops in new areas of their territories as threats to their lands, autonomy, economy, and cultural identities. If the troops were accompanied by many dependents, these suspicious and fears could be aggravated. It may prove difficult to convince minority groups that such deployment would be to their benefit and would not result in permanent Vietnamese encroachment on their lands or in progressive "Vietnamization" of the tribes. Conceivably, such deployment, especially without full agreement of the minorities, could lead to renewed active resistance on their part. In many

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*(U) United Fighting Front of the Oppressed Races, a Montagnard movement demanding greater autonomy for the ethnic minorities. Now reformed, in part, as the Movement for the Unity of the Southern Highlands Minority Party.

instances, the minority groups may prefer that the Saigon government supply them with arms and equipment and let them defend themselves. The formation of a Montagnard armed force has been one of FULRO's demands, and the deployment of ARVN units along the border could be viewed by the Montagnards as a GVN attempt to avoid arming them.

(U) Some tribal groups, such as the Katu, may be sufficiently under VC influence that they constitute an internal threat to the border security forces. Success in gaining their support could be very slow, and action to resettle or control them might complicate border control operations and provoke unfavorable political reactions among other tribes and minority groups.

(U) The deployment of substantial ARVN forces in minority areas would thus raise a number of issues of both local (e.g., relations between ARVN units and native inhabitants) and national significance.

MIXED MANNING OF THE BORDER SECURITY SYSTEM

(C) There are several possible "mixes" of different RVN forces for the border security system. One would be a combination of ARVN and RF forces (including Montagnard CIDG personnel being converted to RF units). One form this mix might take is for RF units to be incorporated as the patrol component, with ARVN supplying fire support (artillery) and maneuver (quick-reaction) forces.

(U) Use Of RF For Surveillance-Interdiction And Area Security Patrols. The RF, recruited and organized by province, operate within their own provinces, nominally under the control of the province chief. They are local inhabitants, familiar with the people, terrain, customs, etc. of their areas, and therefore are generally accepted. They are also familiar with enemy patterns of activity, and know those local inhabitants who sympathize with and provide support to the enemy.

(C) Table 32 displays an estimate of early-1970 RF and CIDG strength in the border provinces (out of a total RF strength of 270,000 troops).

(S) Table 32

EARLY-1970 RF AND CIDG LEVELS AND DISPOSITION IN BORDER PROVINCES (U)

CTZ	RF	CIDG
I	2,000	0
II	6,000	7,000
III	4,500	4,500
IV	4,500	4,500
Total	17,000	16,000

(C) The total border-province force of 33,000 personnel is well above the level required for providing the manning of the strong-point system patrols.* In general, the CIDG has been undertaking a border security mission for a number of years, and utilization of these forces for patrol activities is worthy of investigation. The RF, on the other hand, have a number of responsibilities within their provinces, and committing the bulk of these forces to border security is unlikely.

(C) Although it may be possible to develop the necessary manpower with RF and converted CIDG units, several issues are likely to arise. These issues (listed below) are certainly not unique to a border control force; in fact, in one form or another, many have existed in the past. But they would be aggravated by the system of strong-points contemplated.

1) RF units may not be willing to serve with the ARVN without special incentives. Since these units would be used in what they may regard as the more dangerous missions, i.e., patrolling the border area while ARVN units stay in the strong-points, they may seek equivalent pay and other benefits. This would aggravate already inflationary RVNAF payscales.(32)

*(C) Each strong-point has 240 men in two patrol companies; a total of from 15,100 to 21,600 troops, depending on the threat level.

2) RF training is not the same as that of ARVN.* Raising RF units to the same level would require additional training. What is more important, the SIP concept involves highly trained, specially equipped teams provided with sensors, starlight scopes, radars, and several types of ordnance including remotely fired claymores. RF units using such equipment would require at the minimum an intensive training program.

3) In ethnic minority areas where CIDG are converted to RF and/or incorporated into ARVN units, the situation may be even more difficult. Aside from the need for additional training, past experience has proven it difficult for ethnic minorities and ARVN units to work effectively together. Cultural and linguistic differences, as well as mutual dislike and suspicion, tend to make cooperation uneven and uncertain. Putting the converted units under ARVN control may aggravate frictions between the two, and call for more tact and forbearance than many ARVN commanders and troops have been inclined to show in the past. Furthermore, the Montagnards, who could be used for service along the border, will probably be derived from many tribes; and it may prove difficult, as well as ineffective, to station units comprised of members of one tribe on the territory of another. To overcome some of these difficulties, incentives (in addition to ARVN pay levels) may be required; e.g., land grants, local medical and educational facilities, etc. Clearly, a sympathetic and enlightened attitude on the part of the GVN, senior

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*(C) On the other hand, CIDG forces, which have been receiving intensive OJT training from U.S. Special Forces for almost ten years, might prove more adept at the border control mission than the ARVN.

ARVN, and local province and district chiefs would be required.

4) Above all, RF and converted CIDG troops used in the border security system will have to develop confidence in the fire support and reaction forces provided by ARVN. Should there be a failure in such support, as at times in the past, it would affect the willingness of border patrols to carry out their missions and lead to a degradation in system performance.

(U) Use of RF For Reaction Forces. Use of RF for reaction forces would further reduce the need for the ARVN in border security operations. It might also make the RF patrols less likely to question the extent to which they would receive support in combat situations requiring reaction forces. On the other hand, even more RF units from the border provinces would be required than for patrol duty alone, although the reaction forces would for the most part be held in reserve (similar to present use of RF).

(C) In summary, the use of RF and converted CIDG forces in the strong-points would have advantages in reducing the number of ARVN troops required. Such an allocation would also take advantage of RF familiarity with local customs, terrain, enemy patterns, etc. But serious issues could arise with province chiefs about command and control, recruiting of RF replacements, etc. And the efficiency of mixed manning might be low, at least initially, until ARVN and RF forces became capable of joint operations.* For converted CIDG, the difficulties would be even more pronounced because of the ethnic minority status of these units.

OTHER IMPLICATIONS OF AN IMPROVED BORDER SECURITY PROGRAM

(C) Training Of Specialized Personnel. The VIM program already includes substantial training i[illegible] almost all fields related to military

*(U) In some parts of III CTZ and IV CTZ, ARVN and RF units do operate together, but as separate forces only temporarily under a single command.

operations, including service and maintenance of air, water, and ground vehicles, communications equipment, and weapons. The border security system would require additional training in the massive use of surveillance equipment. Training of RVN forces in sensor use has been underway since mid-1969 at Dong Ha and Vung Tau. United States sensor control and management platoons (SCAMP), DCPG technical liaison teams (TLT), combined instruction teams (CIT), etc. are also training RVN forces. This is followed by OJT with U.S. military advisory training teams. The initial training period is about one month, followed by a four- to six-month period of supervision until the units have attained operational capability. The RVN will eventually have their own training teams.

(S) This training program is geared to current use of sensors. Implementation of an enhanced border surveillance program and widespread use of sensors by strong-point personnel will necessitate a larger training program. If the South Vietnamese are to take over all responsibilities for the system (operating and maintaining relays, display, data-handling, and processing equipment), a further expansion of the training program will be required. Although we cannot state precisely the number of RVN military personnel needing training for the border security system, probably more than 25,000 troops will be involved.

(C) Experience has shown that the South Vietnamese are capable of absorbing such training. However, since we can assume that the VC/NVA will adopt countermeasures to some of the equipment and tactics, any RVNAF program would require a continual upgrading. Therefore, the border surveillance program may require extensive U.S. technological participation for several years, and perhaps even indefinitely as new equipment is continually introduced.

(C) Misuse Of Resources. Past experience also suggests that costs continually arise as a result of illegal diversion of allocated materiel and resources at various levels of the South Vietnamese administrative and military organizations. The additional costs resulting from such diversions or from the misuse or inefficient use of

equipment and materiel cannot be predicted, but could conceivably represent a significant percentage of allocated resources. Presumably, the strong-point, which calls for large investments in materiel and equipment, construction, and maintenance may offer great opportunity for such diversions. Although resulting losses may possibly be kept low, the required additional supervision of materiel allocation would increase costs, at least incrementally.

(C) Displacement of Population. The implementation of a security system in the border area, particularly in I CTZ and II CTZ, would probably result in some movement of the population. Experience has shown that an increase in military activity induces a portion of the local population to leave, especially newly created free-fire zones. Although the magnitude of this population displacement cannot be assessed with confidence, it is a potential source of refugees.

(C) Displacement should be avoided as far as possible. Encouraging local inhabitants not only to remain, but to support the border security system by providing information on enemy activities,* by assisting in construction, and by accepting the forces and their dependents who move into the area, may require various types of incentives; e.g., food, employment, assistance in agricultural techniques and devices, etc. Where displacement is unavoidable, a plan for resettlement of the inhabitants could reduce the unfavorable consequences.

(U) In summary, the implementation of a border security system would have a number of cultural, political, and economic implications. To the extent that these can be foreseen and appropriate plans, programs, and incentives provided, some of the difficulties can be avoided. These implications of border security are considered as important as the military and technological aspects.

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*(C) Providing selected inhabitants with communication devices could create a useful intelligence source.

VIII. CONCLUDING REMARKS

(C) Preceding sections of this report have considered several means of improving border security in South Vietnam. The implications of these systems in terms of internal security, the VIM program, costs and benefits, and some cultural, political and economic factors have been discussed. Certain more general observations are also warranted.

(C) South Vietnam has been the scene of armed conflict for many years. Viet Cong activity within the country, supported by the NVA from outside, has made internal security the primary concern of both political and military officials. U.S. participation in the conflict has inflicted heavy losses on the enemy; and, by most indications, internal security has improved since early 1968. However, the North Vietnamese retain a substantial capability for major attack across the border in I and II Corps.

(U) The U.S. has been withdrawing forces, with public acknowledgment that the rate of withdrawal is geared to some combination of 1) progress in the Paris negotiations, 2) progress in the improvement and modernization program for South Vietnamese forces (VIM), 3) the safety of remaining U.S. troops, and 4) the extent of enemy infiltration.

(U) The VIM program is aimed at increasing the capability of the South Vietnamese forces to the point where they can conduct military operations with a minimum of U.S. support. Initially, at least, these operations focus on maintaining or improving internal security with Regional Forces (RF) taking over an increased responsibility in many areas. The VIM program is, in itself, a major undertaking since it is an attempt to provide South Vietnam with an improved military capability, within a relatively few years, based on incorporating a great deal of U.S. military equipment.

(U) How successfully or how fast South Vietnamese forces can absorb this equipment is not apparent, although present indications are that the program is proceeding successfully in many respects. Nevertheless, the internal security threat and the external threat of infiltration and invasion remain.

(C) Means of improving border security against the threat of infiltration have been receiving considerable attention, in part stimulated by the development of new technology for detecting enemy movement. To some extent, this technology is also to be eventually incorporated in South Vietnamese military capabilities. Within the next few years South Vietnamese forces are thus expected to:

1) Develop increased combat capability under the VIM program;
2) Take over the operations of withdrawn U.S. forces;
3) Maintain or improve internal security;
4) Maintain the capability to respond to a full scale invasion from North Vietnam;
5) Increase their efforts in border security, particularly through the use of an advanced technology.

(C) These tasks constitute a demanding and formidable program. It will not be surprising if frequent setbacks occur even with no major increase in enemy activity. Should the enemy make a major effort, we assume that he will be successful, at least temporarily, in delaying the program. Under these circumstances, it is possible (and even likely) that improved border security based on the deployment of forces to the border areas would be of a lower priority than use of the available forces for maintaining internal security.

(C) Because of the uncertainties involved in the type and magnitude of enemy actions, in the progress of the VIM program, and in the internal security situation, it seems advisable to undertake an evolutionary program to improve border security. Based on the type of border security system considered in this report (i.e., manned strong-points plus enhanced border surveillance), one approach could be to select specific border areas and install strong-points and the accompanying surveillance capability.

(C) This approach has several advantages:

1) It would expose any problems that might develop in installing and manning the strong-points, and thus provide experience for subsequent installations.

2) It would indicate the type of enemy reaction to the program and provide evidence of those aspects of the installations that deserve more attention.
3) It would test the extent to which some of the cultural and political implications are significant, and indicate the direction of programs to ameliorate the more serious ones.
4) It could indicate the extent to which improved border security requirements affected the VIM program.
5) It could provide the necessary operational situations for developing tactical procedures that, in turn, could influence training programs.
6) If undertaken primarily by South Vietnamese forces, it could permit them to modify or develop tactical concepts and operational procedures in line with their own approach to border security.
7) It could provide a preliminary assessment of the effectiveness of a concerted attempt to reduce infiltration by land.

(C) The choice of appropriate border areas for the initial installations can probably best be decided by a combined U.S. and RVN planning group. (This study makes no attempt to identify the areas.)

(C) If the implementation of the initial installations had an adverse effect:

1) On the progress of the VIM program because it required the commitment of too many assets to border security;
2) On the ability to maintain internal security because it required the deployment to the border of forces necessary for maintaining internal security;
3) On South Vietnamese capabilities to take over the responsibilities of withdrawing U.S. forces, because it spread South Vietnamese forces too thin;

4) On cultural and political conditions;

then the large-scale program for improved border security would have to be postponed or modified.

(C) On the other hand, if success with the initial installations justified the investment, the next evolutionary step in an improved border security program could be initiated. In a war in which there have been many false starts and extravagent claims, prudence and economics justify a cautious approach.

Appendix

COMPARISON OF DECEMBER 1969 & VIM FORCES

ESTIMATED 1973 VIM FORCE LEVELS

(C) Our estimates are based on planning documents used for the Phase I VIM program and the following assumptions:

1) United States combat troop withdrawal will be essentially completed by the end of 1973.
2) Compared with December 1969, some increase in the regular forces--i.e., the Army of the Republic of Vietnam (ARVN), the Air Force (VNAF), the Navy (VNN) and the Marine Corps (VNMC)--will occur during various phases of the VIM program. Increases in the Territorial Forces--i.e., the Regional Forces (RF) and Popular Forces (PF)--will also occur. The level of some of the paramilitary and civil forces will decrease, partly as a result of incorporating the Civilian Irregular Defense Group (CIDG) in other forces.

(C) Based on these assumptions, the estimated 1973 force level in South Vietnam is displayed in Table 33, which also shows the December 1969 force levels. Not included are the People's Self-Defense Forces (PSDF), although a large increase in these forces is programmed.

(S) Table 34 displays the December 1969 distribution of in-country ground forces by type and location. Considering the changes in the nature of the war during the spring of 1970, it is not likely that the 1973 force disposition will be distributed throughout South Vietnam as before. In fact, it is not at all clear that (as a result of internal political pressures) the present CTZ structure will remain unchanged. For these reasons, no attempt has been made in this report to predict the 1973 force distribution. But based on VIM plans as of the spring of 1970, we can estimate country-wide force types for 1973: 189 ARVN maneuver battalions, 52 ARVN artillery battalions, 1550 Regional Force companies, and 6200 Popular Force platoons.

(S) Table 33

DECEMBER 1969 & ESTIMATED 1973 FORCES IN SOUTH VIETNAM[a]

Force	Dec. 1969 Strength (x1000)	Estimated 1973 Strength (x1000)
United States	485	0[b]
Republic of Vietnam		
Army (ARVN)	388	420
Air Force (VNAF)	36	38
Navy (VNN)	32	45
Marines (VNMC)	13	14
Regional Forces (RF)	270	288
Popular Forces (PF)	215	257
Paramilitary/Civil[c]	204	150
Total	1643	1212

[a]Excludes third-country forces and supporting forces based outside South Vietnam.

[b]Excludes military assistance personnel.

[c]Includes National Police, Revolutionary Development Cadre, and Civilian Irregular Defense Groups.

(S) Table 34

DECEMBER 1969 DISPOSITION OF GROUND FORCES (U)

	Maneuver Battalions		Territorial Forces[a]	
			Regional (RF)	Popular (PF)
	U.S.	RVN[b]	Companies	Platoons
I CTZ	39	40	215	925
II CTZ	17	34	360	1290
III CTZ	41	62	370	1000
IV CTZ	0	49	530	2275
Total	97[c]	185[c]	1475	5490

[a]Excludes CIDG, National Police, RD Cadre and People's Self-Defense Forces.

[b]ARVN plus VNMC.

[c]In addition, there are over 70 U.S. and an estimated 45 RVN artillery battalions.

ESTIMATED 1973 VNAF

(S) Estimates of the scope of the VIM program for the Vietnamese Air Force have been made by the Assistant for Vietnamization, DCS Plans and Operations of the Air Staff.* In our recapitulation, only aircraft capable of delivering ordnance have been included; i.e., fighter and attack aircraft, fixed-wing gunships, and armed helicopters. Table 35 displays the types and numbers; the total VNAF deployment, present and planned, is displayed in Fig. 23.

(S) Table 35

ESTIMATED 1973 VNAF AIRCRAFT BY TYPE (U)

	Fighter/Attack Aircraft			Gunships		Armed Helicopters
Total	F-5	A-37	A-1	AC-47	AC-119	UH-1[a]
394	18	144	96	18	18	100

[a]Assumes approximately 100 armed helicopters out of a total estimated inventory of over 500 helicopters.

(S) Table 36 compares the estimated 1973 VNAF forces with December 1969 force levels of U.S. and VNAF attack-capable aircraft and helicopters in South Vietnam. Obviously, the estimated 1973 VIM level for VNAF is markedly lower than the present combined force level.

(S) Table 36

DECEMBER 1969 AND ESTIMATED 1973 AIRCRAFT IN SOUTH VIETNAM (U)

	Fighter/Attack[a]	Gunships	Armed Helicopters
December 1969 U.S.	494	32	570[b]
December 1969 VNAF	151	15	---[c]
FY 1973 VNAF	258	36	100

[a]Includes F-4, F-100, and A-37 aircraft for U.S.

[b]Based on 370 UH-1, plus 10 percent of 2000 other helicopters as armed.

[c]Data not available.

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*(U) Personal Communication, June 1970.

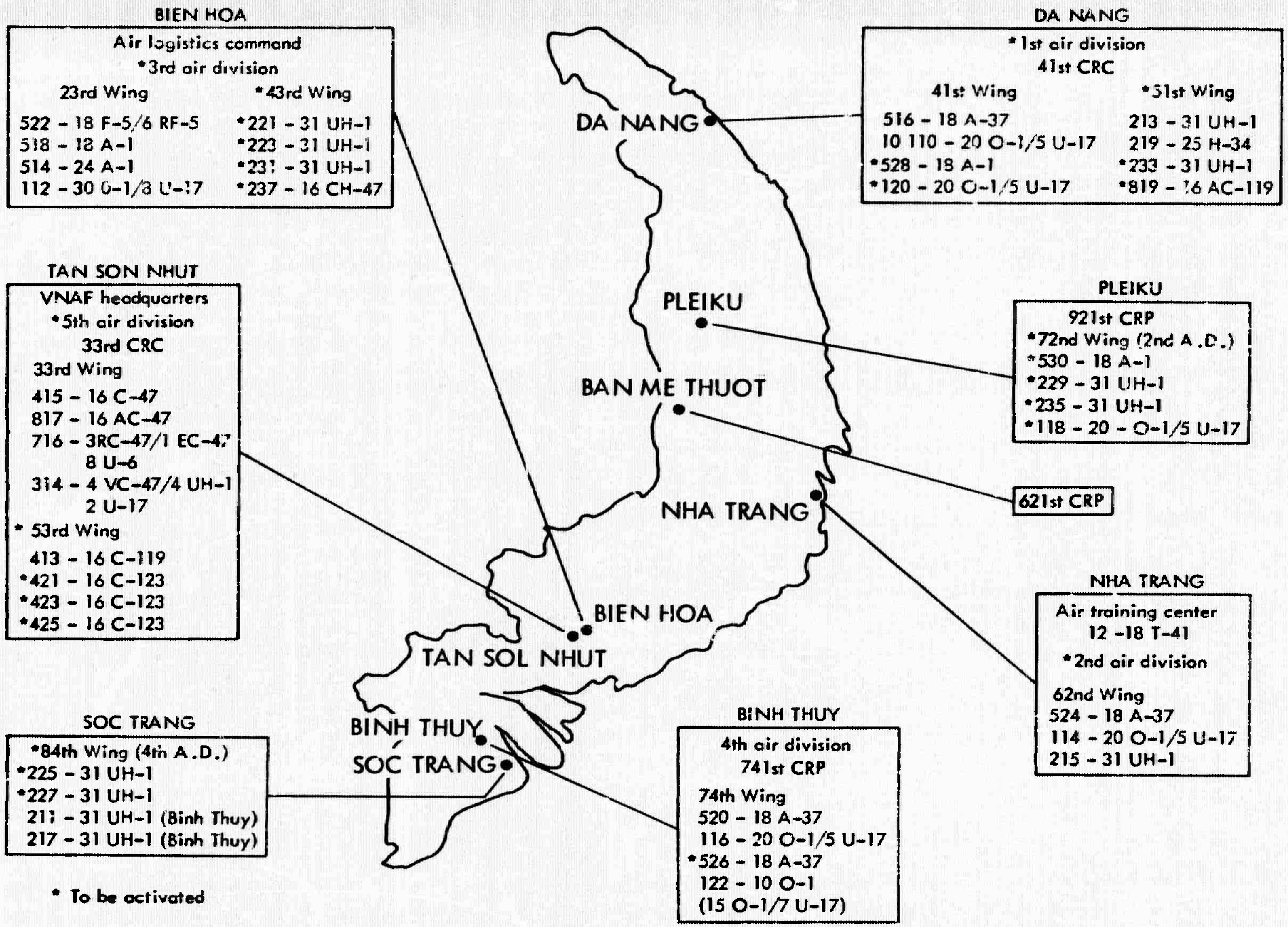

Fig.23 — VNAF present and planned deployment (as of 6/70)

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10. ABSTRACT

(U) This summary report is concerned specifically with infiltration of personnel across the land borders of South Vietnam. Three border security programs are discussed: enhanced border surveillance and two manned systems--a strong-point system and a barrier system (strong-points plus barrier). The two latter systems would involve "screening forces" deployed forward for surveillance and interdiction and "fire support and maneuver forces" to engage the enemy. The strong-point system would consist of a string of semi-independent defense positions to survey the border area and provide immediate local reaction with forces, including artillery and helicopters. The barrier would increase the capability of the strong-point for immediate and local reaction to infiltration. The barrier type considered in this report employs detection devices linked to emplaced ordnance through a communication network under human control. The costs and effectiveness of the three programs are estimated.

11. KEY WORDS

Border Security
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